EVERYBODY'S HANDBOOK *of*

MACHINIST'S KINKS

WITH 287 ILLUSTRATIONS

POPULAR MECHANICS PRESS
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EVERYBODY'S HANDBOOK
OF
MACHINIST'S KINKS

A time-saving lot of 419 ideas for anyone interested
in the fascinating work of a machinist. Each
article is the discovery of a practical
man, and will be of value to either
an amateur or an expert.

WITH 287 ILLUSTRATIONS

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The 419 discoveries in this book may be classified under the following heads:

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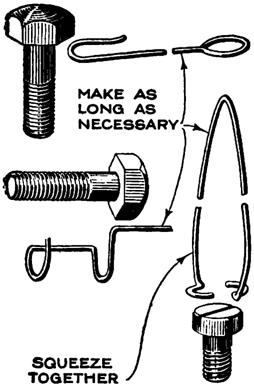
EVERYBODY'S HANDBOOK OF MACHINIST'S KINKS

Entering Small Screws in Awkward Places

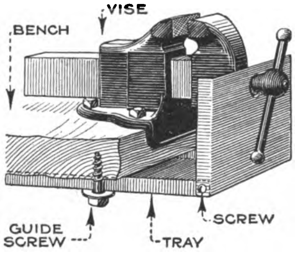
In overhauling or assembling small machines, the mechanic, sooner or later, encounters one or more screw holes that appear to be inaccessible. The insertion in such holes of small bolts and nuts without proper tools is most exasperating, and the simple tools shown in the drawing are intended to overcome the difficulties. One of them is merely a hook at the end of a piece of light, stiff wire, for placing bolts and screws into a hole when they can be dropped vertically. The second tool is for placing the parts into horizontally drilled holes, and the third is for holding the bolt or screw vertically, while it is being lowered into an inaccessible hole at the bottom of a well or pipe. All three tools can be made in a few minutes.



Tray under Vise Catches Small Pieces

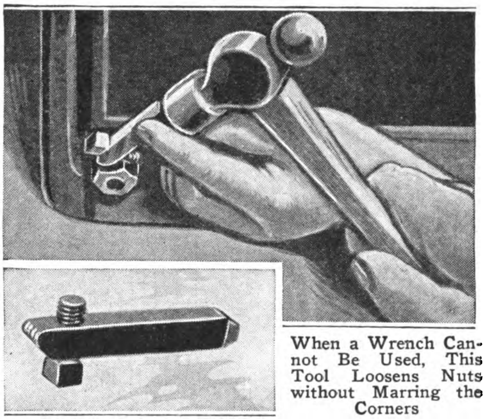
When a vise is used for holding small pieces, it frequently happens that the work becomes loose, or slips through the fingers while being removed, and falls to the floor, where it is often lost in a crack.

This can be prevented very easily by fitting a tray to the bench so that it extends under the vise, as shown in the drawing. The tray consists of a piece of sheet tin, bent at right angles, and with the sides turned up and fastened at the corners with small screws. A hole cut in the front fits over the vise screw, and the bottom of the tray slides underneath the bench between two lagscrews fitted with washers.



Tool for Loosening Nuts

It is a very common practice, and a poor one, to use a hammer and chisel for removing nuts in positions where it is impossible to reach them with a wrench, or impossible to swing a wrench even if it can be placed on the nut. The chisel cuts and mars the edges so that they are very often unfit for further use. By using the simple tool shown in the photograph, however, it is possible to remove the nuts without injuring them.


When a Wrench Cannot Be Used, This Tool Loosens Nuts without Marring the Corners

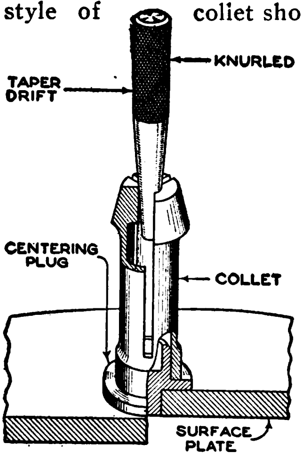
A piece of square stock, of suitable length, is rounded and checkered on one end with a file and the other end is chamfered. About ½ in. from the checkered end, a hole is drilled and tapped for a setscrew, and the point of the tool is then hardened and tempered. In using it, the checkered edge grips the nut securely, and the setscrew acts as a stop, preventing the tool from slipping. Only a slight mark will be left on the nut as evidence of the use of the tool.

Internal Limit Gauge

While internal limit gauges, for determining the minimum and maximum allowable sizes of holes, are usually marked to distinguish the "go" and the "not-go" ends, the figures or letters are quite small, and they must be read each time so that the proper end may be used.

To eliminate this trouble, we knurled all our gauges on the "not-go" end, so that the inspector would know, by feel, which end he was using.—J. H. Moore.

Making Push-Out Collets



The drawing shows an idea that has been worked out in the making of push-out-type collets for screw machines. The style of collet shown by the illustration has three jaws, and is made in a range of sizes from 1/8 to 2-in. capacity.

The first operation in making the collet is to machine it out complete by first roughing in a chuck and then finishing on an arbor, allowing .020 in. to grind in the bore. The slots are then completely milled out, after which the work is placed in the furnace. The critical point of the work is the following operation: After the collet has been heated to the required temperature and "soaked" for the proper period, it is withdrawn from the furnace and stood vertically on a cast-iron surface plate with a centering plug, as shown. This plug is bored out at the top, so as to heat easily and not chill the collet; then, a taper drift is driven into the top of the collet opening, expanding the jaws, after which the work is quenched and drawn for temper. The collet is then cleaned up and placed in the nosepiece of the screw machine on which it is to be used, and the bore ground to size with a portable electric grinder.

Collets made in this manner have entirely overcome the tendency to remain closed when working, and have a good amount of inherent spring, no matter how long in use. As they are ground to the machine, they are very accurate, and, altogether, the method has been found superior to leaving a web that is later ground out and depending upon distortion for the spring. However, it should be noted that the important part of the operation is the amount of opening the jaws get while heated.

Gluing Rubber to Metal

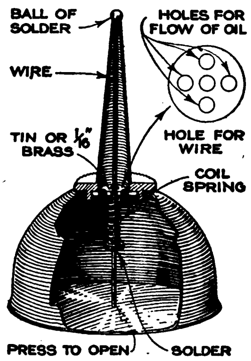
The rubber pad on the big wheel of a bandsaw became loose, and several attempts to glue it tight resulted in failure, until the following preparation was made and applied:

From the bindery of a printing house, a quantity of flexible glue was obtained; this was melted and thoroughly mixed with an equal quantity of acetic acid. The surface of the wheel and of the pad were scraped clean, and both were scrubbed with a solution of oxalic acid, about a teaspoonful of the acid crystals being dissolved in a pint of warm water. Both surfaces were wiped dry, after which they were given a coat of the glue-acid mixture. In about a half hour this was dry, and the surface of the wheel was then coated with glue, using, in this instance, a commercial brand of prepared glue. Then the rubber pad was stretched on and tapped with a piece of board all the way around the wheel. The next day, when the glue had hardened, it was found that the pad was attached to the wheel tighter than it had ever been.

The glue-and-acid mixture is effective for cementing other materials, such as glass, celluloid, china, and the like, to metal.—Edwin R. Mason, Indianapolis, Indiana.

A Nonspillable Oilcan

Any oilcan of standard make can be made nonspillable by using materials to be found around the average shop.



As shown in the drawing, a piece of light sheet tin or brass is cut to fit inside the screwed end of the spout; five holes are drilled in this, the center hole being 3/32 in. in diameter. This is then soldered into place in the screw recess. A piece of 3/32-in. brass wire has a ball of solder attached to the end so that it will close up the opening in the spout, and the wire is cut so that it will just touch the bottom of the can when the ball rests on the opening. The wire is slipped through the spout and the center hole in the disk, a small coil spring placed on the wire as shown, and a washer soldered to the wire to keep a slight tension on the spring. An oilcan of this description cannot spill its contents, and the bottom will never lose its spring.—Andrew Crowe, S. Manchester, Conn.

Homemade Lift Pump

It is frequently desired to have a pump for emergency service where a tedious, slow bailing out with a pail would otherwise have to be resorted to. The pump illustrated can be cheaply and easily made, and will serve the purpose as well as an expensive manufactured article.

For the pump barrel, or cylinder, A, Fig. 1, a piece of 2-in. pipe, about 12 in. long, should be provided, and threaded at each end for standard pipe threads. The inside surface should be carefully filed and smoothed, to remove all irregularities. Three circular washers are required for the pump plunger: two of leather, or rubber, corresponding in size to the inside diameter of the pipe; the third, B, of hardwood, or metal, slightly smaller than the pipe, and smoothed up on both sides, to form a water-tight joint for the plunger. This washer forms the seat of the plunger valve, and is provided with a 1-in. hole for the passage of water when pumping. In the upper washer C, Fig. 2, a narrow slot is cut so that the 1⅛-in. center piece, or flap, is attached only through a short strip, which acts as a hinge, allowing the flap to swing up or down, corresponding to the open or closed position of the plunger valve. To assist the flap in closing readily, a weight should be fastened to its upper side. The bottom washer simply acts as an additional plunger packing.

In order to attach the plunger to its rod, D, a bail, E, must be provided. This may consist of a piece of round bar, threaded at each end for standard nuts, and bent to the shape shown in Fig. 1. The three washers should be clamped together, and drilled to fit the parallel ends of the bail, after which the various parts can be assembled and fastened with the nuts, the upper ones acting as a shoulder against which the washers are drawn up by the lower nuts. If it is not convenient to thread the ends of the bail, a simpler construction would be to provide suitable metal washers, and solder them in the place otherwise occupied by the upper nuts. With the plunger disks in place, a small metal washer should be slipped over the projecting ends of the bail, and these riveted over to form a head. A suitable iron rod should be provided for the plunger rod, and one end securely bent around the bail, and soldered in place to prevent slipping.

For the discharge of the pump a 2-in. elbow will answer. In this should be drilled a hole providing a loose fit for the plunger rod to pass through. In assembling the pump, the discharge elbow is screwed onto the pipe A, and the plunger put in position with one end of the rod passing through the hole in the elbow, whereupon a suitable handle is bent on the plunger rod. Water can then be pumped, but it will be necessary to have the lower end submerged all the time in order to draw up any water. It may not always be convenient to be so near the water, in which case a foot valve must be made and attached to the lower end of the pump cylinder, with the necessary water line and fittings. In operation with a foot valve, the greatest vertical distance the pump can work at, will be 10 to 15 ft., depending on the water-tightness of the plunger in the pump cylinder.

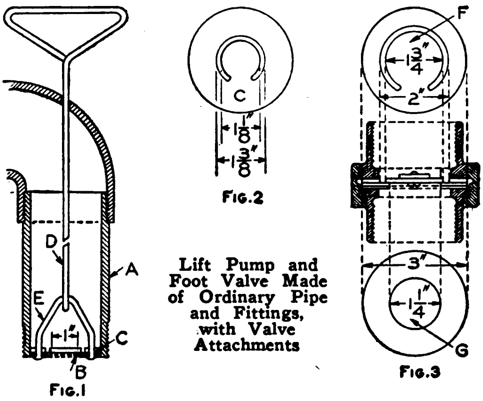


Fig. 1

Fig. 2

Fig. 3

Lift Pump and Foot Valve Made of Ordinary Pipe and Fittings, with Valve Attachments

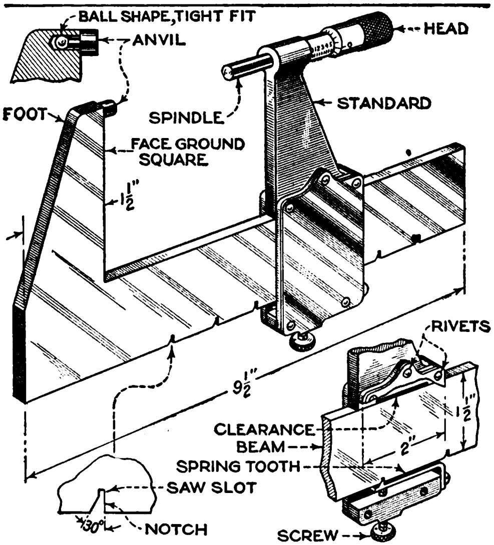
The foot valve consists of a 2-in. pipe union provided with a flap valve similar to that in the plunger. Two leather washers should be made, as shown at F and G, Fig. 3. The upper washer F is provided with a hinged flap, acting as a valve. A 3-in. metal, or wooden, disk, with a 1¼-in. hole through the center and both sides smoothly finished, can be used as valve seat for the flap to close against. A weight fastened to the flap will assist it in closing rapidly. In assembling the union, the usual rubber washer between the ends is omitted, and the three disks are inserted in its place, with the metal valve seat in the center, the flap disk at the top, and the plain washer at the bottom, to prevent any leakage through the union except through the main passage of the valve. The completed foot valve may then be attached to the pump, either with a length of plain pipe and coupling, as in a straight lift, or with a hose and necessary fittings, for places which can be reached only by a crooked suction line.—G. M. Heimroth, Whitestone, L. I.

Making a Beam Micrometer

The cost of a complete set of micrometer calipers prohibits the average toolmaker or machinist from owning one; a beam micrometer also, while not so expensive as a complete set, is beyond the reach of many. With the exercise of a little skill, however, accurate beam micrometers may readily be made by the workman himself.

The toolmaker, and others whose work demands an accurate tool, will find the micrometer shown in the larger drawing well worth making, as it can be made just as accurate as any of the high-priced tools on the market.

The beam or frame is made of ¼-in. steel, 9½ in. long and 5 or 6 in. wide, depending upon how high it is desired to make the spindle and anvil. This height should be either 3 or 4 in., and the width of the beam 1½ in. The inner edges of the foot and beam must be absolutely true and square with each other, if the tool is to be accurate, and great care must be taken with this part of the work. The foot is drilled for the anvil, which is of tool steel, made, as shown in the sectional detail, with a ball-shaped end and a shank smaller in diameter than the hole. This allows the inner face of the anvil to seat squarely against the surface of the foot; the ball must be a tight press fit.



Beam Micrometer, Measuring from 0 to 6 Inches, That May Be Made by Any Skilled Workman

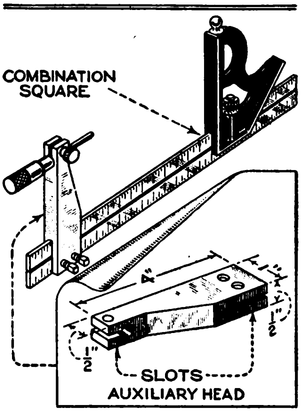
The micrometer-head standard is built up of flat steel, the upper part, carrying the head, being shaped from ½-in. stock, leaving the diameter of the eye ½ in., and the body ¼ in. thick. This is connected to the bottom piece by ⅛-in. side plates, the whole being assembled tightly by perfect-fitting rivets, neatly headed. A clearance slot is filed in the bottom surface of the upper part of the standard, so that it has a two-point bearing on the beam.

The locating spring tooth is made of tool steel, hardened and tempered, and is fastened to the bottom piece by a round-head screw. The shape of the notches in which the tooth rests should be particularly noticed. This form of notch divides the work of locating the standard and of drawing it to position. When the screw is turned upward to press the tooth home, the inclined side of the notch, engaging with the corresponding side of the tooth, slides the standard until the straight sides of notch and tooth are in contact. It is only necessary to make the straight sides of the notches accurate as to location, and, as all of the wear comes on the inclined side, this accuracy is retained indefinitely. When the screw is released, the tooth will spring out of the notch with a little end pressure. The micrometer head is lightly pressed into the eye in the standard in the usual manner, and the contact surfaces of the anvil and spindle lapped true.

Where extreme accuracy is not essential, a micrometer head, attached by means of a simple bracket, or auxiliary head, to the scale of a combination square, will serve the purpose, the head of the square being used as the anvil. It is preferable to use a square with a hardened drop-forged steel head.

The auxiliary head is made from a piece of cast iron or steel, ½ by 1 by 4 in. in dimensions, machined all over by the size given in the smaller drawing. A hole to fit a standard micrometer head is then drilled through it, and, at right angles to this, a hole is drilled and tapped for a binding screw, the head slotted as shown, and one side of the binding-screw hole drilled out to fit the body of the screw; the screw used has a knurled head. The bottom of the head is now slotted to fit nicely on the scale, holes for two small setscrews are drilled and tapped in one side, in line with the scale groove, and the screws fitted.

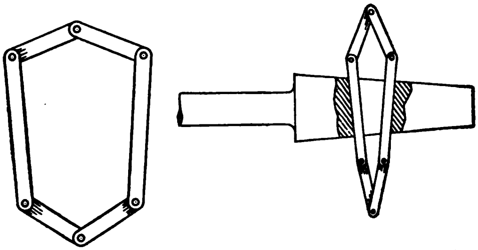
To use the tool, the square head is set on a scale division, and, with the micrometer reading at zero, the auxiliary head is moved up, until the end of the spindle just touches the square head, and locked in position. The square head is then moved the desired number of divisions, locked, and the micrometer used as usual. When setting the head on the scale divisions, a magnifying glass should be used.



A better way to set the tool is to use a set of the micrometer standards sold by various tool companies, but where these are not available, the magnifying glass will enable the workman to set the tool as closely as the ordinary vernier caliper may be adjusted. A tool of this kind has been used for a long time and has given splendid service.

Adjustable Template for Making Taper Keys

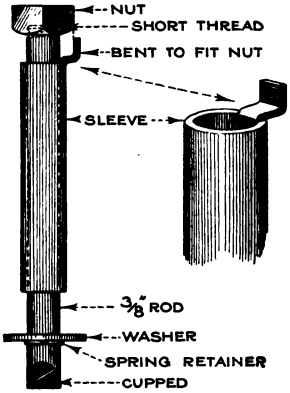
The making and fitting of taper keys is usually guesswork, as there is no means of accurately ascertaining the taper of the slot, for instance, in a piston rod. The sketch is descriptive of a simple jig that will be found quite efficient for this work. I made one of discarded hacksaw blades, 6 in. long. When the jig is placed in the slot and spread to the inside faces of the ends it affords a perfect template to lay off the key for machining. The length of the key can be marked lightly with chalk on the template, allowing no chance for a mistake nor for waste of material.—F. W. Bently, Milwaukee, Wis.



Template Made of Discarded Hacksaw Blades for Obtaining the Shape of a Taper Hole

Starting Nuts in Slots

The tool shown in the illustration has proved of considerable assistance in placing washers and starting nuts on bolts located in a hole, or slot, so deep that one cannot get at them with the fingers.



The tool is made of a short length of 3/8-in. steel rod of the same diameter as the bolt threads. A groove is cut around it near one end, to allow a spring-wire ring, or retainer, to be snapped in. This ring is cut so that it can be compressed in the groove, to allow a washer to be slipped over it. When released, the retainer will spread out and prevent the washer from slipping off. The end of the rod, near the retainer, is cupped so that it will fit on the round end of a bolt. The other end of the rod is threaded to the same pitch as the nut to be screwed in place; only a few threads are required. A sleeve, made of steel tubing, and fitting neatly on the rod, is cut and bent to grip the nut.

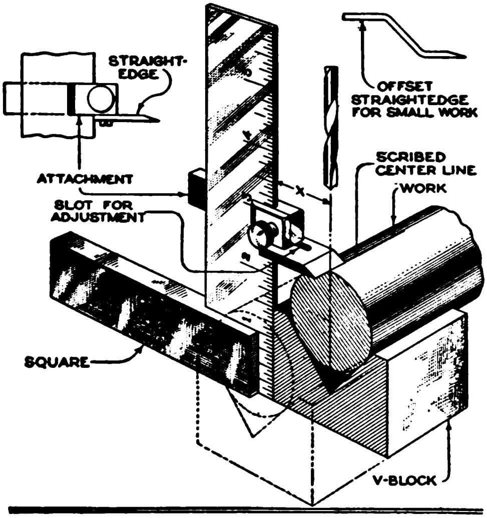
The tool is loaded for use by pushing a washer over the spring retainer, and screwing a nut on the threaded end. Then the cupped end of the tool is rested on the end of the bolt, and the sleeve is pushed down, forcing the washer over the retainer and onto the bolt. The other end of the tool is then placed in the slot, and the nut is screwed on the end of the bolt. While the threaded end of the tool is being unscrewed from the nut, the hook on the sleeve is held against it, to prevent it from being screwed off again.

Magneto Magnets Used for Clamps

Old magnets from the magneto of a well-known light automobile, which are obtainable at garages and service stations, can be used to make serviceable clamps for bolting work down to machine tables. What magnetism there may be remaining in the parts can be removed by heating them to a bright red, and quenching in water.—J. H. Rouse, San Francisco, California.

Try-Square Centering Attachment

An easily made device to clamp on the blade of a steel try-square, for laying out center lines on cylindrical work, is shown in the illustration. As the attachment slides up and down on the blade and can be clamped in any position, work of any size that the V-block will accommodate can be center-scribed. The attachment will be found especially convenient in laying out work for drilling, marking keyways, etc. A piece of steel plate is grooved to make a sliding fit over the try-square blade, to which it is clamped by means of a small plate and knurled thumbscrew. To the bottom is screwed a straightedge blade made of tempered tool steel; this may be provided with a slot, if desired, for adjusting to different-sized V-blocks. The final adjustment of the straightedge blade should be such that the distance X, from the edge of the try-square blade to the beveled edge of the straightedge blade, equals the exact distance from the side of the V-block to the center of the "V."



An Attachment for the Try-Square That Facilitates the Layout of Cylindrical Work to Be Drilled or in Which Keyways Are to Be Cut

When laying out for drilling, the work is clamped in the V-block, or blocks, and the distance from the end to the center of the required hole scribed on it, at right angles to the axis. The try-square is set vertically on the drill-press table, the attachment slipped over and moved down until the straightedge touches the work, the front edge of the blade being held against the side of the V-block. Then the clamp screw is tightened, and taking care to see that the try-square stock rests squarely against the table, and the blade against the V-block with stock at right angles, the center line is scribed intersecting the previously marked transverse line.

If the V-block is of the precision type, the mark may be checked by bringing the square up against the other side; otherwise, the same side of the block must always be used. In case the work is so small that it lies below the edges of the "V," an offset straightedge, extending down into the "V," may be used.—H. H. Parker, Oakland, Calif.

How to Properly Key a Pulley

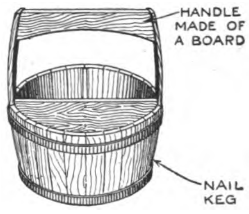
It is something of a trick to key a pulley so that it will not work loose after a time, especially if the pulley is large and runs at a high rate of speed. In making the key, care must be taken that it be of uniform width and fit the seat in the shaft and the pulley snugly. The key should be driven tight, but not so tight that it will kink under the blow.

If the pulley runs with the hub against the box, which is the usual way, allow only about 1/32 in. end play between the box and the pulley.

When an old key is worn too thin, but fits properly otherwise, place a strip of tin under it to make it fill the keyway closely. To draw a key, a small end of which is projecting, hold it with a pair of pliers, pry against the hub of the pulley, at the same time driving the hub on the shaft with a hammer. This will loosen both the pulley and the key. If the key is cut off flush with the pulley, it may be necessary to remove the shaft and drive from the inside, in which case it is well to drive the pulley on a little, to loosen the key.

Shop Tray Made from Nail Keg

A nail keg, cut down as indicated in the sketch, makes a handy tray for use in the shop. Two of the staves are left full length, and between their upper ends a board is fastened for use as a handle. The carrier is handy either for carrying tools or materials about the shop, or for keeping parts from getting lost when a machine is being taken apart.

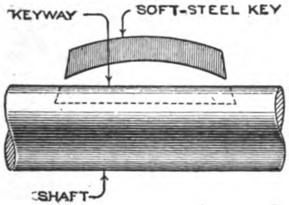

HANDLE MADE OF A BOARD
NAIL KEG

¶Calipering the front end of a hole does not show that it is bored straight.

Repairing Broken Gears with Horseshoe Toe Calks

While operating a tractor, the iron handle on the end of the furrow-guide lifting rope fell into the drivewheel gears and broke off two of the teeth. Rather than suffer a long delay while waiting for a new wheel, the broken teeth were repaired with screw calks. The face of the wheel was 3 in. wide, and two holes were drilled into each of the broken teeth; these holes were tapped, and the calks from a set of old horseshoes were inserted after the threads had been recut to correspond with the holes in the wheel. After the calks had been screwed into place, the corners at the base were dressed off to conform with the teeth of the other gear. This repair was done without even removing the wheel from the tractor.—George G. McVicker, North Bend, Nebr.

Inserting a Tight Key or Feather



In some machines it is necessary to use a key that is inserted in the plain part of the shaft, away from the end, and to have the key, or feather, fixed in place. Such a key can be made by the following method: Cut the keyway as usual, but undercut the ends, as shown in the sketch. Make a soft-steel key of exactly the same size and shape as the keyway, including the beveled ends. The key will, of course, be too long to insert. Bend it, as shown, until it can be dropped or tapped into the keyway, and straighten it out in place with a few sharp hammer blows. If properly made, the key will hold very firmly.

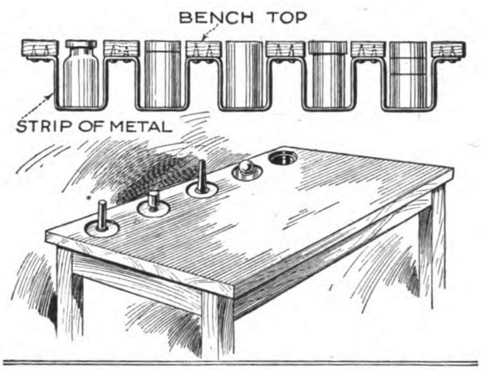
It is necessary to allow a little material for finishing up the key after it has been hammered home. Do not try this plan for a very short key, as the bend will not straighten out properly.—Howard Greene, New York City.

Holding a Small, Irregular Piece in a Vise

Small pieces of material, which are difficult to hold in a vise or other clamp, should be fastened to a small block having its sides parallel, and then clamped into position. If there are no holes through the piece, which may be of wood or metal, the screws may be placed along the edges to act as clamps.

Holding Containers on Bench

The drawing illustrates an excellent method of holding small bottles and containers in place on the workbench, to prevent them from being upset, pushed off, or broken accidentally.



Neat and Convenient Method of Holding Containers on a Bench to Prevent Them from Being Overturned Accidentally, or Damaged

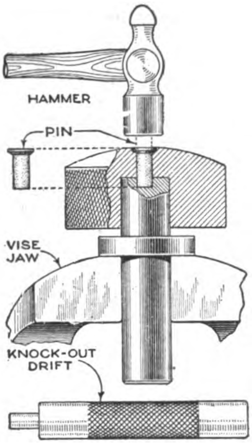
A number of holes are bored through the bench top, near the rear edge, so that the bottles will be well out of the way. A strip of metal, bent as indicated, and fastened to the underside of the bench top, holds the containers in place. The holes are bored of various sizes, corresponding to the diameters of the bottles, and the metal strip is bent so that the top of each container is flush with the surface of the bench top.

Soldering a Broken File

A thin round file that had been broken in two was repaired satisfactorily by soldering, much to my surprise, ordinary solder, chloride-of-zinc flux, and an alcohol lamp being used in the process. I first tinned the broken ends and then heated them just enough to melt the solder. The ends were dipped in solder and were then held together until the solder had set. During the entire process I took great care not to heat the parts more than necessary to melt the solder, and as a result, found that the temper of the file was not injured except at the joint. The repaired file was found to be almost as strong as it was originally.—Wm. J. Edmonds, Rutland, Vt.

¶Grease or vaseline, rubbed on the hands before starting on a dirty job, will keep the dirt out of the pores, and enable the hands to be cleaned much more easily afterward.

A Fixture for Swaging Rawhide Pins



In manufacturing some special machines, rawhide pins with flat heads were needed, and as these were not a commercial product, we were forced to make them ourselves. After some experimenting, the pins were made from the ⅛-in. rawhide pins used in connection with a certain kind of belt fastener, in this manner: An anvil piece arranged with a flange to be held in a vise, as indicated, was made from tough oil-hardened steel. The cap, of glass-hardened tool steel, slides over the upper part of the anvil, and the hole in the cap is made to conform to the final shape of the pin, the length of the latter before forming being indicated by the dotted lines. The pin is first cut to length with a pair of pliers, inserted into the opening in the cap, and the projecting end is swaged down with a light hammer. The cap is then lifted from the anvil, and the knock-out drift shown is used for removing the pin. A production of 180 pins an hour was obtained with this arrangement.—Burr Bennett, Honesdale, Pennsylvania.

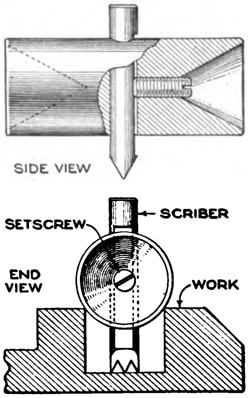
A Plate-Glass Lap

For finishing small parts, such as the bottoms and flats of steel nuts, thin plates, and other flat-metal surfaces, a "lap" made from a sheet of abrasive cloth glued to a piece of thick plate glass is convenient. The lap is laid on a smooth surface so that it does not rock, oil is applied, and the objects are worked back and forth by hand in a manner similar to the method of finishing by moving them back and forth over the teeth of a flat file clamped to the bench. A sheet of plate glass, about 4 by 8 in. and ¼ to ⅜ in. thick, is a good size. This glass usually has a nearly plane surface; in fact, often serves the amateur mechanic as a surface plate, but to make sure, the piece should be tested lengthwise, crosswise and diagonally with a steel straightedge. Cut the abrasive-cloth sheet the same size as the glass, apply glue, and clamp together in a vise between two soft-wood boards until the glue has set.

How to Clean Tools

To keep tools clean and bright rub a little mercury ointment over them, which will form a moisture-resisting coating. Mercurial ointment is also known as blue butter. It is somewhat poisonous, so should be handled carefully. Another good mixture to keep tools from rusting is made by taking six parts of lard and one part of resin. Heat these together slowly until the resin is all melted. The mixture should be heated in the open air in case of fire, and benzine added in about the proportion of one pint of benzine to half a pound of the mixture. When cool, the mixture can be rubbed lightly over the bright-steel articles. Tools thus treated will resist the corrosive action even of salt water.

A Slot-Center Scriber



To draw accurately a central line down slotted work entails a good deal of preparatory work in the form of setting up the job, etc. Anyone having much work of this character to do, such as drilling holes in the centers of slots, milling, or other operations of a similar nature, will at once appreciate the usefulness of the extremely simple scriber illustrated.

A piece of 2-in. cold-rolled steel, about 3 or 4 in. long, is relieved at both ends to reduce the weight, a hole being drilled at right angles to the axis to take the ⅜-in. drill-rod scriber. One end is tapped for a ¼-in. setscrew that bears against a flat on one side of the scriber. The scriber is provided with three points, the purpose of which is obvious, although only the center line is ordinarily noted. In use, the tool is placed in the slot, as shown, the scriber pressed down and secured, and the device then slid along to mark the work.

¶To close the sides of a used cotter pin, hold one of its legs on the edge of a vise and tap the head with a hammer.

Calibrating Pressure Gauges

Most instructions for making small pressure gauges give little or no information about their calibration; the usual instructions are to connect the gauge to an air line in series with a standard gauge. Even if a standard gauge is available, it might conceivably be inaccurate itself; in any event, the gauge maker should know how to construct apparatus for calibrating gauges, without depending upon other instruments of doubtful accuracy.

In this connection, the methods of a gauge manufacturer will be of interest. This concern manufactures gauges of all kinds and sizes, from automobile fuel-tank and oil-pressure gauges that have bent tubes with a wall thickness of only .002 in. and indicate from 4 to 6-lb. maximum pressure, to hydraulic gauges which indicate upward of 300,000 lb. to the square inch, and have a tube of tool steel, drilled from the solid, bent while red-hot, and finally tempered. When these gauges are ready for calibration, it is not done by connecting them up with a standard gauge.

The worker who calibrates the newly made gauges, or who sets the printed dials so that the hand registers correctly, has a small device, shown in Fig. 1, consisting of a plunger pump, actuated by a screw on which is a knurled handwheel. The pump chamber opens into an upright column, in which is supported a plunger; the bottom of the plunger is flat and rests on a flat seat. There is an opening in the seat whose area is ⅕ sq. in. exactly. The top of the plunger has a circular platform, about 4 in. in diameter, on which the weights are placed. Connected to the bottom of this column and open to the pressure from the pump, is a standard pipe connection to which the gauge to be calibrated is fastened. The whole thing is filled with oil.

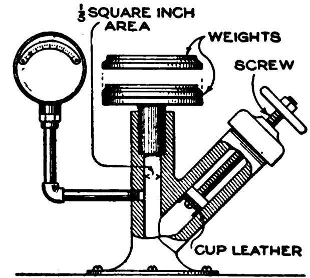


Fig. 1

Now it is evident that if a weight of one pound is placed on the platform it will require a hydraulic pressure of 5 lb. to the square inch to raise it, since the area of the opening in the seat under the plunger is ⅕ sq. in. There are about 100 lb. of brass weights, all machined and fitting into one another. The weights actually weighing 1 lb. are marked 5 lb., the 2-lb. weight is marked 10, etc. When the plunger of the pump is screwed down, the hand on the gauge will reach a certain point with one weight on the plate. Beyond this point it cannot go, for if the pump is screwed down farther, the weight will lift. A mark is placed on the dial (on the hand-calibrated type), and one may be sure that it is correct in proportion to the number of weights on the platform.

By changing the size of the aperture under the plunger, which is easily done with removable valve seats, the values of these same weights may be changed. Thus an area of .1 sq. in. would require 10-lb. pressure to lift a 1-lb. weight.

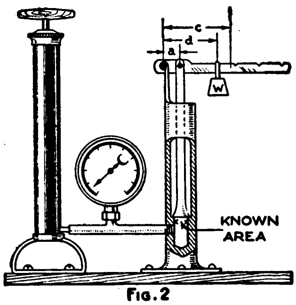


Fig. 2

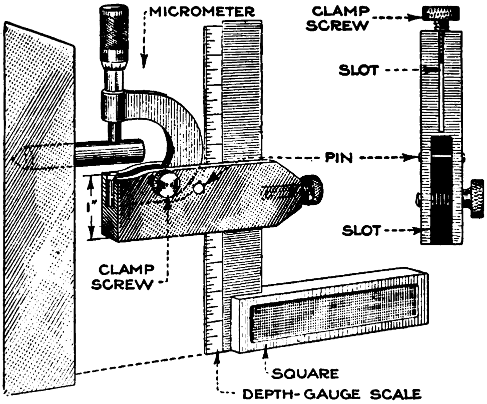
An amateur can make a simple apparatus similar to the one described, using a set of ordinary avoirdupois weights; or a beam with a sliding weight may be constructed using only one weight. The pump may be a bicycle-tire pump. The column should be high enough to prevent the oil from overflowing when the pressure has reached the point where it will lift the plunger. This upright is shown in section; the rest is simple enough to understand.

When notching the beam for the various positions of the weight W, its weight in pounds being known, use the following formula to calculate the distance of the weight from the fulcrum for each desired pressure:

$$d=\frac{a(pA-W_1)-W_2c}{W};$$

where d=distance from fulcrum to weight, in inches; c=distance from fulcrum to center of gravity of lever, in inches; a=distance from fulcrum to center line of valve, in inches; A= area of orifice beneath bottom of valve, in square inches; W=weight, in pounds; W_1= weight of valve and stem, in pounds; W_2 =weight of lever, in pounds; and p=desired pressure, in pounds per square inch. Variations of this tester will suggest themselves to the maker.

Micrometer Height Gauge



A Substitute for the High-Priced Micrometer Depth Gauge: The Mechanic Can Make It Himself from the Tools That Already Form a Part of His Kit

The height gauge, although a very useful tool, is beyond the reach of many mechanics by reason of its cost. However, a very serviceable instrument can be easily made from the tools found in most kits—a micrometer, square, and depth-gauge scale, held together by the attachment shown in the drawing. The clamping device for holding the micrometer to the perpendicular scale is made from a piece of ½-in. flat steel, slotted at the top for the micrometer frame, and at the rear for the square blade and scale. The slot at the rear is the same width throughout, as the blade of the square and scale will be alike, or nearly so, in thickness. Before this slot is cut, however, the attachment is tapped for the screw which holds the square and scale parts together. The micrometer is held to the attachment by a clamping screw which binds the instrument tightly. When the micrometer has been lined up squarely, a small hole is drilled and a pin inserted; thus, when the tool is to be assembled, it is only necessary to slide the micrometer along the slot until the frame touches the pin, when the screw is tightened.

The distance from the top of the micrometer anvil to the bottom of the clamp should be exactly 1 in. Then, when measuring the height of a plug 4.560 in. from the surface plate, the attachment would be set so that the bottom was exactly on the 3-in. line of the scale; this, plus the 1-in. thickness of the attachment, gives 4 in., the height of the anvil face. The micrometer spindle is now raised .560 in., which is the correct height of the plug. If care is taken in reading the scale, accurate results will be had. However, if 1-in. measuring blocks are at hand, the insertion of three of these would give the highest accuracy much more easily.

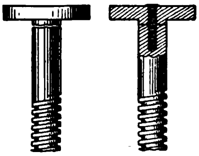
Rewinding Flat Tape

The cardboard ends of several spools of flat wrapping tape were broken off in storage, and the tape, thus loosened, became badly tangled. An effort to rewind it upon another spool resulted in more tangles and twists, and it looked as though the tape would have to be scrapped.

By removing the guard and blades from an electric fan, placing one end of a new spool on the armature shaft of the fan and supporting the opposite end with a pencil, all the tape was wound without twists or snarls in a short time. One man controlled the speed of the fan and held the pencil, and another guided the tape as the spool revolved. Rubber bands, wrapped about the end of the armature shaft, formed an effective friction "clutch."

Temporary Repair on a Broken Valve Spindle

The breaking of a brass valve spindle is of no uncommon occurrence and the break invariably takes place at or near the top of the shoulder that secures the valve seat, or disk, to the spindle.



When such a break happens on a piece of machinery far from a repair shop the repair can be made on the spot, as taps and drills of some kind are almost invariably to be found in the engine room, and with these tools it is a simple matter to temporarily repair the spindles.

File off the lower end of the broken spindle squarely and remove the part remaining on the shoulder plate. Center the two pieces and drill a hole, for the size of tap to be used, through the plate and a short distance into the spindle. Tap both holes and connect the parts with the threaded end of a common machine bolt, and cut it off to allow sufficient end for beading over a small portion against the shoulder plate. This method will often permit a valve to give efficient service until a new spindle can be made.—F. W. Bently, Milwaukee, Wis.

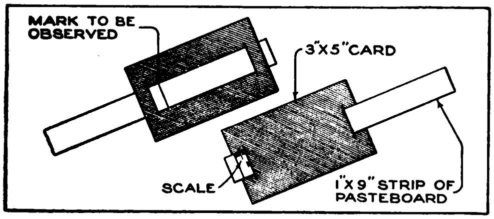
Learn to Read Any Scale by Tenths

By H. KURTZ RANDALL

ONE of the most widely useful things to learn for any mechanic who does precision work, and one which comparatively few take the trouble to master, is to read tenths of a division on a scale. The electrical worker usually learns it, so that he can look at a voltmeter, say, with scale marks for every volt, and "take a reading" of 37.3 volts, or 153.7 volts—where the novice, looking at the same meter, would read merely 37 or 154. The machinist who must lay off a dimension of .97 in. usually considers that he requires a scale graduated in hundredths; but the electrical draftsman who can read tenths may lay off the same dimension just as accurately with a tenth-inch scale—the work involving much less strain on the eyes than using the finer scale. To measure a distance of 1.678 in., and be sure that it is not 1.677 or 1.679, the ordinary workman needs a micrometer. But if the eye is trained to estimate tenths, a hundredth-inch scale and a good magnifying glass are all that is necessary.

A little instrument made of paper, as illustrated, will be of great assistance in training the eye for this purpose. A strip of pasteboard is cut, 1 in. wide and 9 in. long. Beginning ½ in. from the left end, a scale of 100 parts should be laid out and numbered, like the one here shown; or the printed scale can be cut out and pasted to the strip. On the other side of the strip, exactly opposite the 100 mark of the scale, rule a line across the strip.

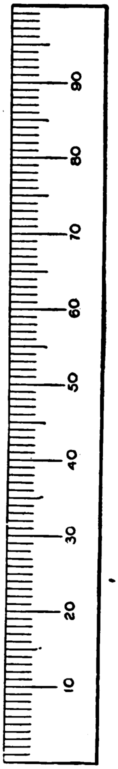
Now obtain a card, about 3 by 5 in., of a different color from the 1-in. strip. Make two slits in it, exactly as far apart as the length of the scale. Lay the narrow strip, scale-side down, upon the card and pass the ends through the slits. The instrument is now complete.



Two Pieces of Cardboard Are the Only Necessary Materials for Making an Instrument to Train the Eye in Reading Tenths of Divisions on a Scale

For the first lesson, set the strip so that the "10" mark just coincides with the slit in the card, as in the picture. Then turn the instrument over, right to left—not top to bottom—and observe very closely the position of the cross mark with reference to the two slits. Identify this position in the mind with .1 (one-tenth). Then shift the strip to "20" on the scale, and again note the position of the cross mark on the reverse side, remembering it as .2. Proceed in this way until familiar with the appearance of a line placed at .1, .2, or any such part, up to .9, of the distance from the left side of a space to the right side.

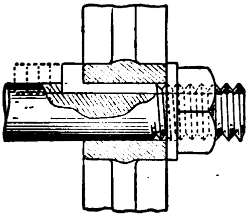
Then test the estimating ability thus acquired, as follows: Set the cross mark at any point between the slits, at random, doing this preferably with the eyes closed. Try to estimate which tenth mark is most nearly represented by this position of the cross mark. After a little practice, the correct figure should be named in almost every case. Perfection is not to be expected; the eye training may be considered good if the nearest figure is named correctly in all cases where the actual distance, as read on the scale, is within .03 of the whole. That is, if the setting is actually .77, or .825, the eye should be able to name positively the nearest tenth (.8)—but if the actual setting is .747, or .768, some uncertainty may be expected as to whether the nearest tenth is .7 or .8. It should be remarked in this connection that when the measurements are used afterward in calculation, the error resulting from reading .747 as .8 instead of .7, is a very slight one, while if the actual distance is .727, the use of .8 instead of .7 would introduce a considerably greater error.



After some experience is acquired through these methods, it will be interesting to try setting the instrument at random, as before, and estimating hundredths instead of tenths, turning the card each time to test the accuracy of the estimate. After some practice at this, it may be possible to estimate in nearly all cases within an error of .02 of the whole distance.

This means that with a steel scale graduated in hundredths, and a magnifying glass, one may measure the length of a piece of metal with an error of less than .0002 in.—equal to what the ordinary workman does with a micrometer. For it must be understood, to grasp the importance of this work, that the ability of the eye to estimate decimal parts is entirely independent of the size of the whole. The length of the printed scale, for example, is 10 centimeters, but once the decimal parts are fixed in the mind, it is as easy to read hundredths of a .01-in. space (ten-thousandths of an inch) as to read hundredths of 10 cm. (millimeters). This is, of course, limited by the fineness of the vision, or—which amounts to the same thing—by the power of the magnifier available. But the man with the tenth-reading eye has such an enormous advantage, in these days of ten-thousandth-inch dimensions, that a little practice to gain this ability in accurate scale reading is well worth while.

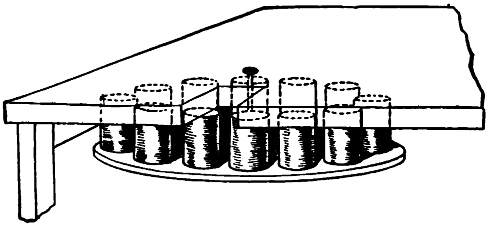
Securing a Wheel in Place with a Threaded Key



In cases where an easy and frequent removal is required for a wheel, secured in a definite position on a straight shaft—not provided with a shoulder—a simple solution of the difficulty is to provide a threaded key, as illustrated. The key has a shoulder at one end, against which the wheel is held. The other end is threaded at the same time the shaft thread is cut, so the two match when a nut is screwed on it. This key need not have the tight fit the usual drive keys must have in order to hold the wheel in position. When necessary to secure the wheel in place, it can be slid on the shaft together with the key, or this put on first, if desired, and the wheel slipped on afterward. The key is then placed so that its threads and those of the shaft match, when the wheel fits in the desired position and against the key gib head. Then, by slipping on a loose collar and screwing on a nut, the wheel will be held rigidly on the shaft between the gib head and the collar. No sliding motion can result when fastened, and an easy removal can at any time be obtained by simply unscrewing the nut.

Revolving Substitute for a Bench Drawer

Where a number of small parts are handled frequently on a bench, a wheel with a number of receptacles to take the place of a drawer will be found very handy. The wheel can be made of a board, revolving on a bolt fastened to the underside of the bench top. The edge of the wheel should come flush with the edge of the bench.



No Part of the Wheel Projects in Front of the Bench When Taking Parts from the Receptacles

The upper surface of the wheel is fitted with as many receptacles as it will hold, made of discarded tin fruit cans, or with small V-shaped boxes. A notch is cut in the bench top large enough to uncover one receptacle at the outer edge. The notch can be fitted with a hinged cover so that trash will not enter any of the receptacles.—Lisle H. Scneder, Topeka, Kans.

Type Cases to Hold Small Parts

Every workshop has as a part of its stock or equipment an assortment of small screws, nuts, bolts and similar small articles, which are difficult to store and classify. To keep these things in order and within reach when wanted, requires a number of small compartments or containers.

One of the best ways of sorting and keeping in order such a stock of small articles is to use printers' type cases. The case is a drawer about 32 in. long, 16 in. wide, and 1⅜ in. deep. It is divided into small compartments by wooden partition strips. A "double" case has 49 compartments or "boxes," 2 in. square, on each side, or a total of 98 divisions. A "triple" case has three lots of boxes, 1¼ by 2 in., or a total of 147 compartments. Several other arrangements of the partitions and divisions can be obtained. The boxes or compartments give room for but a few of each of the pieces and parts, but they provide a rather complete stock in a very small space, where they are always kept in order and ready for use.

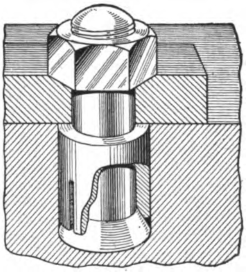
Old type cases can be obtained at bar-gain prices from print shops and supply houses, or new ones, together with stands for holding them, if a number are to be used, can be obtained from type founders. Such a case, mounted as a drawer, underneath a bench, will quickly prove its value.—James W. Cottrell, Hammonton, N. J.

Moving "Rusted-In" Screws

Steel screws which have rusted into place are difficult to remove. They can often be loosened by tapping the screwdriver with a hammer, or by heating, but a better way is to treat them before setting them in place with a rust preventive. Common oil will do this to a slight extent, but a mixture of graphite and tallow rubbed onto the screw, will be effective for a much longer time.—S. Leonard Bastin, Bournemouth, Eng.

A Threadless Stud

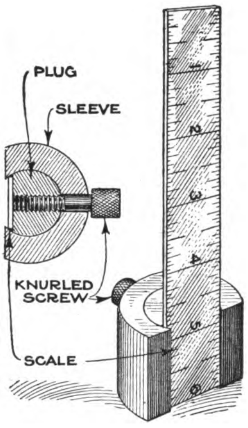
When installing some heavy machinery, it became necessary to fasten parts to the heavy metal base by means of studs. The studs were of large diameter, and no bottom tap of the size was to be had. To get around the difficulty, a bolt was turned up with a tapered head, somewhat resembling a plow bolt. A bushing, the inside diameter of which was a sliding fit on the body of the bolt, was also turned down on the lathe. One end of the bushing was beveled off at an angle corresponding to that of the bolt head, and four slots, 90° apart, were sawed in it, as shown. The bolt and bushing were assembled and placed in the hole in the base. As the nut was tightened the bolt head was drawn up into the bushing, expanding it and clamping it tightly in the base. If the bolt has a tendency to turn when the nut is being tightened it may be doweled to fit the base at the bottom of the hole.



¶Large numerals cut from calendars make excellent labels on closed boxes containing screws and nails, to indicate different sizes, and numerals of different colors can be used to indicate different kinds of nails, as, for instance, common nails and finishing nails.

A Simple Scale Holder

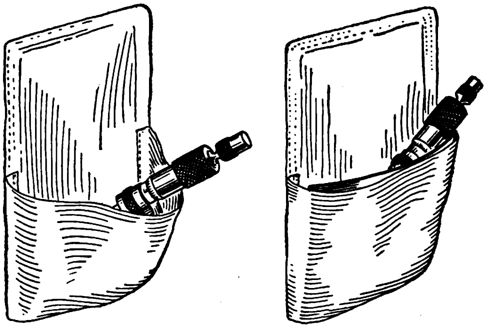
When laying out work set up on the surface plate, some kind of scale holder is usually employed to hold the scale in a vertical position, with its end resting on the plate, so that measurements may be transferred from it to the work by means of the surface gauge. While the combination-square head is generally used for this purpose, homemade holders are also popular, but since in most cases the scale is not adjustable, it often happens that the first mark scribed on the work is not an even number of inches above the plate, but is a mixed number, say, $5\frac{17}{32}$ in. If other lines are to be scribed above and below this line, and located from it, it is very easy to make a mistake in setting the scriber to a fixed scale. A better way is to mark the first line with the end of the scale resting on the plate, and then set the scale to some even inch, corresponding to the height of the surface-gauge scriber. Then it is only necessary to take dimensions from this inch mark, thus avoiding confusion.



The scale holder illustrated herewith holds the scale securely at right angles to the plate, allows the scale to be adjusted vertically, and moreover, is easily made, as no delicate machining, to get a correct line-up when assembled, is required. The holder is made in two pieces, a plug, 1 in. in diameter, and a sleeve or collar that fits neatly around it, the latter having an outside diameter of about 2 in. The plug is then machined flat on one side, until the scale will just slip between it and the sleeve, in the manner shown. The sleeve is also cut away to expose the scale. The two parts are then clamped together, and a hole is drilled and tapped for the knurled tightening screw. A holder made to the dimensions given will be heavy enough to hold a 12 or 24-in. scale solidly. A small brass plug is placed in the tapped hole in front of the tightening screw, so that the scale will not be injured; little pressure is required to hold the scale in any position.

To Prevent a Machinist's Pocket from Sagging

It is customary to place a small hanging pocket in machinists' aprons and shop coats in which to carry a micrometer, or other small tools. It is almost impossible to accidentally spill anything out of the pocket, but most tools carried therein will hang out and away from the body, as shown in the first sketch, where it is liable to be struck by a running lathe chuck or other moving part of a machine.


The Pasteboard Slip Placed in the Pocket Will Keep It Straight and Prevent Sagging

If a piece of pasteboard, the width and depth of the pocket, is placed within, as shown in the second sketch, the pocket will keep its shape and any tool will lie flat against the body where it cannot be broken.—Henry J. Marion, Pontiac, Mich.

Cementing Glass to Metal

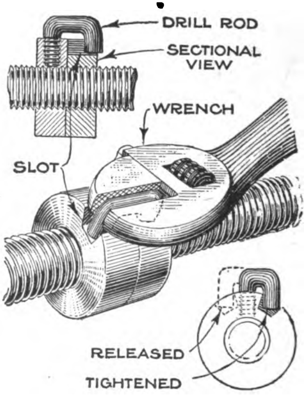
For cementing glass to metal a mixture of sodium silicate and quartz meal, baking 12 to 24 hours to set hard, is recommended. If the color is unimportant a useful preparation may be obtained by soaking leather scrap glue in water, melting it by heat and then mixing it with 11 lb. of pitch, 4½ lb. of asphaltum and 4½ lb. of resin to each 1¾ lb. of glue solution. The mass may be loaded with powdered slate, etc., without losing its adhesive properties. An equally good cement is prepared by dissolving equal parts of Russian glue and shellac, and adding levigated chalk. Casein cement, for immediate use, is made by mixing fresh curd with one-fourth its weight of powdered chalk; while a second preparation, which will keep, consists of a solution of casein in ammonia, or of a solution of the same material in a 5-percent solution of caustic soda or borax, with the addition of a very small proportion of hexamethylene-tetramine. This cement is impervious to water.

Resin adhesives are also used, the "amber" cement employed by jewelers being composed of three parts of mastic and two to four parts of shellac, dissolved to a "sirup" in 90-per-cent alcohol.

Cleaning Files with Block of Wood

Where a file-cleaning brush is not at hand—and it seldom is at hand when wanted—a quick and effective way to clean files is by rubbing them in the direction of the cut with the end-grain edge of a block of soft wood. The fibers of the wood, at the sharp corner, are pressed into the file cuts and clean out the dirt and particles of metal. The wooden block even removes grease and oil, which a much-used file brush will not ordinarily do.

Quick Nut-Locking Device

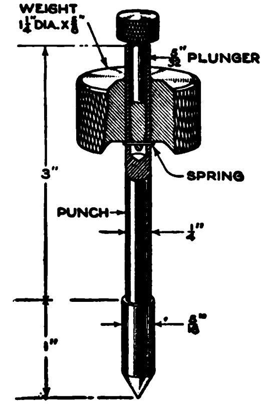


Two nuts, locked together on a threaded bar, are used on many machines. as a means for holding some part at a required setting; some makers of milling machines use this method to set the travel of the table, while on many hand-screw machines, turrets and cross slides are set by the same method. The use of two wrenches is required to tighten or release two ordinary hexagon nuts, with the danger of slipping or altering the setting by unequal pressure. The device shown enables two nuts to be locked together with one wrench easily and without fear of the setting being disturbed while so doing. Instead of the usual hexagon, the nuts are made circular, one being drilled and tapped on the outside, while the other has a slot cut into its circumference. A piece of drill rod is threaded to fit the tapped hole in the first nut and bent over as shown, to fit into the slot of the second. The following method will determine where the slot should be cut: Screw both nuts onto the bar on which they will be used; tighten them up, face to face, until they move freely together, and then scribe a line through the center of the tapped hole and across the other nut to mark the center of the slot. When this is cut, as shown, and the bent drill rod put in place, both will, of course, screw onto the bar in the same position; they can then be moved to any adjustment by hand and tightened with a single wrench by moving the bent rod as shown. The nuts are released by moving the U-shaped drill rod in the opposite direction.

A Semiautomatic Center Punch

A simple and easily made center punch for layout work is shown in the drawing. The punch proper is made of tool steel, hardened and tempered, while the weight and the plunger are made of cold-rolled steel.

The plunger is pointed as shown, and, through a small hole near the point, a short piece of spring wire is driven. The spring fits through two holes in the punch, projecting slightly outside it, so that the weight is supported when at the top of the punch. When the plunger is depressed, the projecting ends of the spring wire are withdrawn, and the weight falls. The point of the plunger, when depressed, should strike the bottom of the hole, so that the ends of the wire spring will not be drawn completely through the small holes and fail to return the plunger.



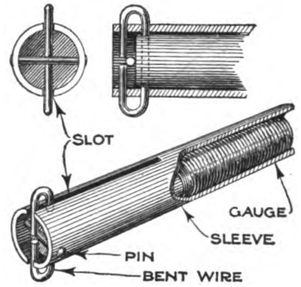
Cutting the Rust from Bolt Threads

If the threads on a bolt or nut are covered with rust, or fit tightly, clean them out with a mixture made as follows: Mix some powdered emery with any kind of grease and smear the threaded parts both inside of the nut and on the bolt, then turn the nut on the bolt and run it back and forth over the threads. This method will be found effective even in the most stubborn cases.—G. N. Beebee, Benning, D. C.

¶After babbitting a bearing, if no reamer is available, take a sharp chisel and raise a burr on opposite sides of a steel shaft of proper size, and use it to ream out the babbitt for a working fit.

Protecting Small Thread Gauges

Thread gauges of the smaller sizes used around the shop very frequently have their usefulness impaired by the numerous knocks they receive in the course of the day's work. Often, too, vibration will jar the gauge off the bench, or some heavy tool will be dropped on it by the careless or busy mechanic. Accurate thread gauges are expensive to make, and are well worth protecting; for this purpose the device shown in the drawing will be found simple and effective. A sleeve is made to fit the largest diameter of the gauge, and long enough to cover its entire length. A slot is cut in the sleeve for about half its length, and at right angles to this, near the slotted end, a hole is drilled, and a pin driven in. The gauge shank is then drilled, close to the end, a drive fit for a 3/32-in. wire, after which it is inserted in the sleeve, and a piece of the wire is driven in. The ends of the wire are bent over the end of the shank in the manner shown, and adjusted until the ends will just spring over the pin in the sleeve. When in use, the gauge is pushed forward by grasping the bent wire, and when not in use, it is pushed back into the sleeve until the ends of the wire snap over the pin.

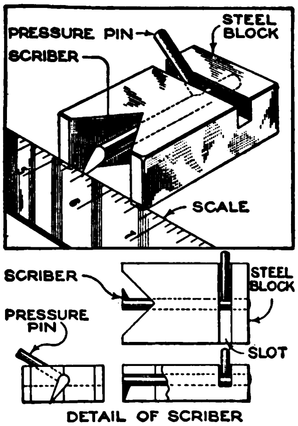


Safety Pockets for Overalls

Mechanics, farmers, and other workers who bend and stoop at their work, often suffer the loss of small tools, and other articles, from the capacious pockets of their overalls or jumpers.

To prevent such losses, a piece of steel from an old corset stay or clock spring is cut to the width of the pocket. The ends of the steel are annealed, and holes are drilled to take small rivets. A slit is cut in the end of the pocket hem, and the spring inserted. The rivets are placed through both cloth and metal, and, after placing washers over the ends, hammered smooth. The spring will keep the gap of the pocket closed, prevent the loss of articles, and keep dust, chaff, etc., from entering.

Precision Scribing Tool



It is an exceedingly delicate operation to scribe a perfectly true line along the edge of a scale with an ordinary scriber or scratch-awl. Since the scriber is round and tapering to a point, and it is almost impossible to keep the hand in exactly the same position the whole time the line is being drawn, an uneven line usually results, which may cut through a fine center on one end of the work and probably be off at the other. If the line is not exactly true, other attempts will be necessary, and this will make other fine lines that will be confusing.

The tool shown in the drawing will draw a dead-straight line exactly between two points, providing, of course, that the scale is accurately placed on the points. The body is a steel block, ground on the base, with a V-cut in the front end. The piece is drilled from the back end clear through to the center of the "V," to take the bent scriber, which is made as shown.

A slot, cut across the top of the block, enables a pin to be threaded into the scriber in a position at right angles to the scriber point. When the piece is thus assembled, a light finishing cut, preferably on the grinder, is taken across the front of the block and end of the scriber, insuring that these will form a dead-flat face.

In use, the block is placed close against the edge of the scale, and, with one finger pressing on the pin, the block is drawn along the scale, scribing a light or heavy line according to the pressure exerted.

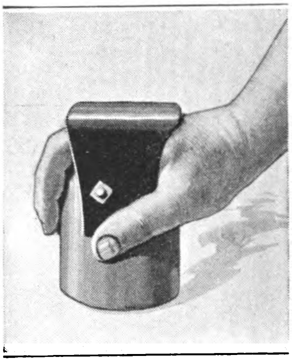
Aluminum Hones

Cast-aluminum hones are now being used in a western shop to take the place of the ordinary hones, as aluminum has an abrasive quality of particular usefulness for fine work. These hones are better in many ways than the ordinary hones, owing to the fact that no lather, oil, or compound is needed to make the aluminum "take hold" of the steel. The tool is merely rubbed on the bare metal in the usual manner.

Aluminum hones may be made in any shop by melting the aluminum in a babbitt ladle and pouring it into a plaster or sand mold with a cavity 2 in. wide, 5 in. long, and ½ in. deep. When the metal is cold, it is polished on a grindstone, or on a grinding disk covered with medium-grade sandpaper. If desired, a hone can be made by cutting a square or rectangular piece out of a discarded aluminum crankcase, or other cast-aluminum article that has a flat surface. The aluminum can also be cast in the form of a common whetstone or a heavy butcher's steel, for use in sharpening kitchen knives and other tools.—David Baxter, Hutchinson, Kans.

Strap Handle for Pounding Block

The common lead block, used in every shop for the purpose of pounding different materials without marking or marring, can be more conveniently handled if a leather or thick-felt strap is attached in the manner shown in the illustration. As a rule, no particular attention is paid to the shape of the block, weight being the only consideration, but it will be found that blocks molded in the end of a tube are both easy to make and handy to use. To attach the handle, a hole is drilled through the lead, near one end, to take a stud about ¼ in. in diameter. The strap is cut out in one piece, and one end is passed over the stud on one side, then brought over the top and over the stud on the opposite side, doubled and brought back to the first side again, leaving enough space between the parts of the strap to insert the hand easily. Then the nuts are screwed tightly. In this manner the bottom part of the strap forms a pad that lessens the shock of the blows, and the top piece enables the workman to lift the weight without gripping the sides all the time. The advantage of making the handle in one piece is that the top portion cannot fall out of an upright position.



To Prevent Dirt from Entering beneath the Finger Nails

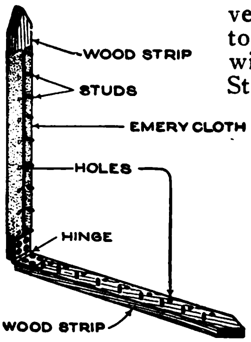
Sometimes a person is called to help repair a machine in a shop where there is considerable dirt and grease. An office man can keep the dirt from getting under the nails by filing the space between them and the fingers with soap. After the work is finished, the soap is easily washed out and the nails cleaned.—Loren Ward, Des Moines, Iowa.

Cutting Oil Grooves

For some classes of work the ordinary oil groove is undesirable. For instance, a tight belt running down from a countershaft exerts a considerable pull on the upper bearing and a liberal oil groove, cut straight across the top, lessens the wearing surface, and hastens a renewal. However, plentiful lubrication must be provided for in some manner. A good way to cut oil grooves is to chuck the bearing, and with a boring tool having a round point cut a thread right through the box. The thread should be of a coarse pitch, say, ½ to 2 threads per inch, depending on the size of the bearing. Right and left threads can be cut, if desired, in the same bearing, each starting from the oil hole and so cut that the oil will follow around the box when the shaft revolves. It is a good plan to check up on the lost power occasionally.

Handy Mounting for Emery Cloth

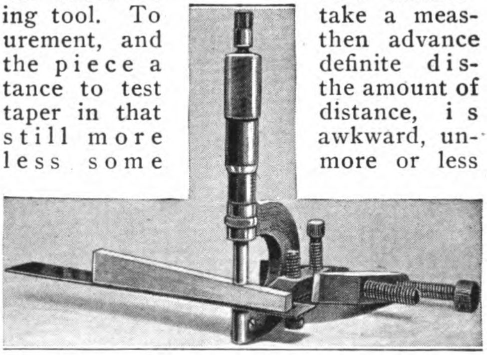
An ingenious device for stretching emery cloth can be made from two pieces of hard wood of convenient length, held together at one end with a hinge, as shown. Studs on each strip fit into corresponding holes on the opposite strip; these studs are made by driving nails into the wood and then cutting off the heads and sharpening the ends with a file.



After one edge of the strip of emery cloth has been applied over one row of studs, the other edge of the cloth is gripped and held tight by closing the "file," as it is commonly called.—F. G. Jenkins, Dalton, N. Y.

Micrometer Attachment for Measuring Tapers

Measuring tapers with a micrometer is always an awkward job, owing to the unsatisfactory surface presented to the flat faces of the measuring tool. To take a measurement, and then advance the piece a definite distance to test the amount of taper in that distance, is still more awkward, unless some more or less expensive device is used. The illustration shows a method that gives very accurate results without requiring any addition to the machinist's tool equipment. To obtain correct alinement, a rule is clamped to the top of the micrometer anvil in the following manner: The micrometer spindle is first brought down until the scale is held between spindle and anvil, exactly as though the scale were being measured. A small clamp is then pressed close to the side of the micrometer and tightened on the scale, a second clamp being used to hold the first to the micrometer. In this way the scale is held flat on the face of the anvil and at right angles to the spindle.


Measuring Tapered Work with a Micrometer Is Greatly Simplified by the Method Shown, Which Requires Nothing but a Few Tools Always Included in the Machinist's Equipment

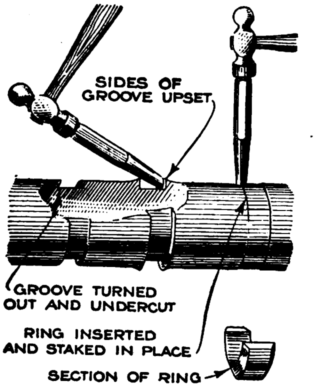
To measure the work for the amount of taper per inch, either end is placed upon some even inch of the scale and a reading taken, after which the piece is moved to the next inch graduation and measured again, the difference between the two readings being, of course, the amount of taper per inch. By this arrangement both hands are left free, as the clamps may be arranged to support the micrometer in a vertical position.

¶To remove a bolt that is "set" or "frozen," or that one has reason to believe cannot be driven out, use as large a wrench as can be handled and tighten down the nut, even if it twists off. This will stretch the bolt and reduce its diameter slightly so that it can be driven out with comparative ease.

Repairing Grooves Worn in Shaft

When a ring-oiling box is found that continues to give trouble from heating, it is generally because one of the rings has stopped turning at some time and worn a groove around the shaft; this groove prevents the oil brought up by the ring from being properly distributed, and, of course, the bearing will not be lubricated. These grooves are not usually noticed until the machine is taken down for repairs of some sort, as they are not noticeable so long as the machine is in operation. If the box is oiled by hand, it will run properly, but if the rings are depended upon to carry the oil, the bearing cannot help but run hot.

When grooves are found in a shaft, particularly if the bearing is an important one, it is essential that they be repaired. Sometimes a new shaft may be put in, but to do this, the machine will often be shut down when it is most needed. Also, the shaft may be turned down small enough to eliminate the grooves, but this makes a new bearing necessary, which is impossible in case the bearing is solid and a gear or pulley goes on the end outside the bearing.


SIDES OF GROOVE UPSET
GROOVE TURNED OUT AND UNDERCUT
RING INSERTED AND STAKED IN PLACE
SECTION OF RING

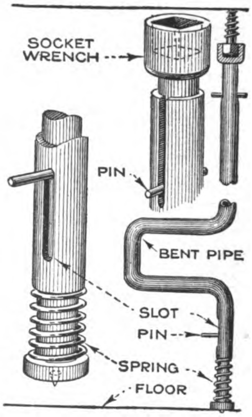
Another method to bring the shaft back to its original condition in a short time is illustrated by the drawing. The grooves are squared out and slightly undercut, and a small punch is then used to bring the sides of the groove parallel by upsetting the metal above the surface of the shaft. A metal ring is turned up with beveled sides to fit into the dovetail groove in the shaft. The ring is sawed in half and the sections placed in the groove, the metal that was upset being staked back in place to hold the ring securely to the shaft. If this operation is done carefully, the shaft will be the same size as before, and the ring can be turned to the exact diameter of the shaft, making it difficult to tell where the ring was applied. Small shims can be inserted to compensate for the metal removed when the ring was sawed. On very small shafts the ring can be held in place with solder, but this does not work so well on larger pieces.—James Ellis, Memphis, Tenn.

Marking Steel with Identification Tags

One of the simplest methods of marking steel is to paint it with a colored stripe, a certain color having been assigned to each kind: red, for example, might be used to indicate "Colonial;" white, "Jessop;" yellow, "Ketos," etc. But if the steel is handled frequently, the color stripes gradually become coated with grease and dirt until they are too dark to be distinguished, or they may even wear off entirely so that the identity of the steel is destroyed. An improvement on this method is to drill a small hole close to the edge of one end of the bar. A metal tag, with the proper identification data on it, can then be wired to the bar. The steel should be used starting with the opposite end so the mark may remain until the last piece is required, when the tag is removed and fastened to the next bar of similar steel.—Chas. V. Eckles, Wessington Springs, So. Dak.

A Brace for Overhead Lag Screws

Much of the difficulty and danger connected with erecting or removing overhead line shafting is eliminated if the lag screws are loosened or tightened with a brace of the type shown in the illustration.



The brace is made of pipe, bent to the shape indicated, and extends from the floor to the ceiling. At the bottom end an extension leg fits loosely inside of the pipe; this leg has a coil spring around it, and a collar and small point are turned at its lower end. A pin, driven into the leg through a slot cut in the pipe, keeps the leg from falling out, and also allows the brace to adjust itself to suit the height of different line shafts. Two slots are cut opposite each other in the top end of the brace, to allow the insertion of a pin-driven socket wrench.—S. A. McDonald, Brooklyn, N. Y.

An Improvised Lifting Jack

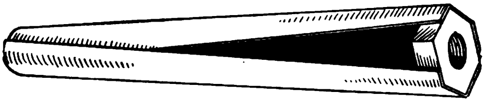
The need of a device for lifting comparatively light objects or constructions while leveling them is often felt, and a jackscrew is not always available. Materials at hand in most small shops were used to make an improvised lifting jack, and it proved satisfactory enough to warrant keeping it for future use. A section of 1-in. pipe was fitted into a wooden block as a base, and a washer was set on top of the pipe. A large machine screw and a nut to fit it were set through the washer and a ratchet wrench was applied to the nut. An ordinary plain or monkey wrench may be used, the ratchet wrench being more convenient and in this instance available.—John Uttley, Hale, Cheshire, Eng.

Screwdrivers from Cycle Spokes

Small screwdrivers for use on cameras, clocks, toys, and similar mechanisms, can be quickly made from bicycle spokes. In making them, the nipples are screwed up to the ends of the threads and forced down as tightly as possible. The threaded end of the spoke, which should project beyond the nipple about 1/16 in., is riveted over smoothly to prevent it from working loose and turning off. The spokes are cut to the desired length; the ends are dressed down with a file, and the blade hardened and tempered. If a wider bit is desired, the end may be hammered flat and dressed. Heavier screwdrivers may be made in the same manner from the spokes of old motorcycle or automobile wheels.

Starting Holder for a Nut

The holder is made of sheet metal, rolled into a tube. A nut is then inserted in one end and the metal hammered to the shape of the nut. Any length of metal can be used, as desired. In use, the shaped end of the metal is slipped over a nut and a slight pressure on the other end will hold the nut so that it can be turned on the threads of a bolt in otherwise inaccessible places. This can be used for temporary service or for aiding assembly work in a factory. It saves much time.—John E. Hollarbush, Huron, So. Dak.

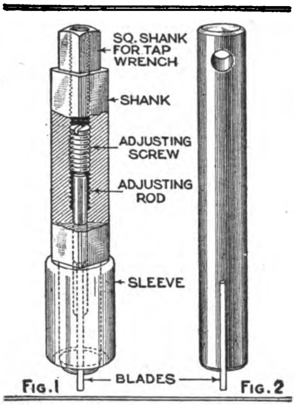


The Holder Made of Sheet Metal Grips a Nut to Start It on the Threads

Screwdrivers for Heavy Service

When inserting large screws or trying to remove tight ones, it is customary to apply a monkey or pipe wrench to the screwdriver shank, which commonly results in bending or breaking the blade without materially altering the position of the screw. The drawing shows two types of all-steel screwdrivers with inserted adjustable and renewable blades for heavy service. In Fig. 1 the shank is made of square cold-rolled stock, and an alternative design, suitable for lighter work, is shown in Fig. 2, that is made from round stock and used with a rod handle.

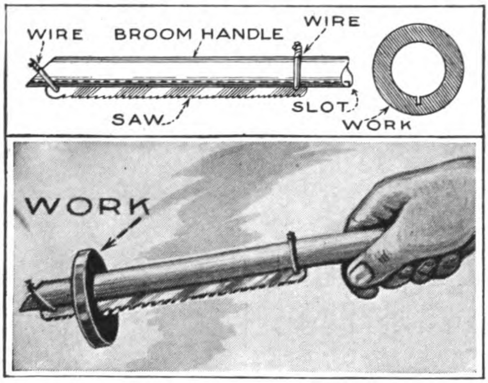
One end of the square bar used to make the type illustrated by Fig. 1 is turned down to a diameter equal to the width across the flats, and is slotted to take the blade. A steel sleeve, made a light driving fit over the cylindrical portion, prevents horizontal movement of the blade. The upper end may be squared off so that the device can be held in a tap wrench, or drilled for a rod handle. A hole is drilled through the center of the stock from the upper end, for about half its length, and this is tapped for the adjusting screw; a smaller hole is drilled through the stock the remainder of the distance, and a piece of drill rod is inserted. This rod, when forced in by the adjusting screw, will push the blade farther out to adjust for different screw heads or in case of blade breakage.



Ordinarily, only enough of the blade projects to fit into the screw head. This blade cannot bend, and if broken, another is quickly adjusted. A flat blade of this kind will grip the screw head much better and with less slippage than the ordinary tapered blade. The square shank permits the application of either a monkey wrench or an end wrench; it may be held in a four-jawed lathe chuck while the work is brought up by a drill pad on the tailstock, and fed in by the tailstock screw to give pressure on the screwdriver blade.—H. H. Parker, Oakland, Calif.

Sawing Slots in Sleeves and Washers

It is very inconvenient to saw internal slots in washers, or sleeves, by means of a common hacksaw, as the blade must be removed from the frame, inserted through the hole, and again be fastened to the frame. A good holder, that makes this unnecessary, can be made from a short piece of broom handle, about 4 in. longer than the saw blade.



A Simple Tool for Sawing Internal Slots in Washers or Sleeves, Made from a Piece of Broomstick

A groove is cut lengthwise in the holder, so that the blade can be inserted to about one-third of its depth. Soft wire is passed through the holes at each end of the blade and is twisted around the holder. The end of the holder is cut at an angle so that the wire, when twisted around this end, will pull the blade taut.

Safety Tool Extracts Particles from the Eye

Mechanics, particularly ironworkers, are continually getting small particles of steel, sawdust, or other substance in their eyes. These foreign bodies are usually removed with a toothpick or match that has been sharpened to a point—a very dangerous instrument in unskilled hands. A safe and convenient instrument for this purpose is made of tool steel; the handle end is hardened and magnetized. On the other end a horsehair is securely fastened with a silk thread, which is then given a coat of shellac to prevent the knot from untying. For convenience and protection, the instrument is screwed into a case made of mild steel.

If the particle in the eye is iron or steel, the magnetized end will often remove it. If not, it can be loosened with the horsehair without danger of injuring the eyeball. If, however, the particle is so deeply imbedded that it does not readily respond to either treatment, a surgeon or eye specialist should be consulted immediately; indeed it is best to have medical attention if the wound is at all serious.—M. L. Lowrey, Livermore, Calif.

Removing a Small Piece of Steel from the Eye

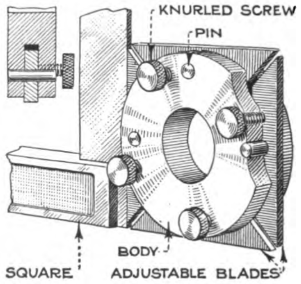
While working at an emery wheel a small particle of steel was thrown into my eye and a fellow workman removed it quickly and without pain in the following manner:

He felt along the lapel and front of his coat for a protruding horsehair of the inner lining used as a stiffener. When found he drew it out and formed it into a loop by folding it double. The eyelid was turned back with the end of a lead pencil, and after the speck of steel was located, it was removed by drawing the loop in the hair over the eye.

The horsehair remover has been used by this man in many instances and has never been found to injure the most sensitive eye.—Hugh Wrigley, Philadelphia, Pa.

A Precision Testing Block

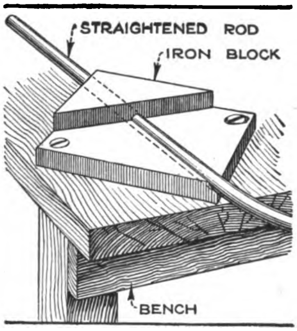
Many shops often feel the need of having something absolutely square for testing purposes, yet very few have facilities for machining a piece so accurately. The drawing shows a testing block that is made up of several parts, and is so constructed that it can be made in any shop, however meager the equipment. The round body is made of machine steel, a hole being drilled or bored through the center for convenience in handling, and a groove cut around the circumference to take the four adjustable blades. The latter, which should be made of tool steel, need not be accurate except on the outside edge, which should be perfectly flat. They are attached to the body, at right angles to each other, by snug-fitting pins through their centers, which allow them to rock against the bottom of the groove. Each blade is tightened separately by a knurled screw, threaded into the body a little to one side of the pins. To set the



block square, place the tool on the surface plate and bring an adjustable-blade square, bevel gauge, or similar device that is capable of being adjusted out of square, against one blade. With both pieces set approximately square, set the four blades alternately, adjusting them and the square or bevel until the block can be turned to all four positions, and the contact between blades and square is light-tight; then tighten all the screws. It will be seen that both the block and the other testing piece must be absolutely square when this result is reached, and that the fixture can be used to prove the squareness of any work, with confidence as to accuracy.

Bench Block for Straightening Rods

For straightening brass or copper rods, the bench block shown in the drawing will give excellent results. This device was used for straightening a number of ½-in. brass rods that had previously been used on tank work and were bent to a semicircular shape. It is made from a square block of steel, drilled diagonally, the hole being made a trifle larger than the diameter of the rods, and part of the block is cut away to half its thickness as shown. Holes are drilled in opposite corners for screws to hold the block to the bench. The bent rods are inserted in the hole as far as possible, then tapped down with a lead hammer and pushed through farther, until the rod passes through the hole.

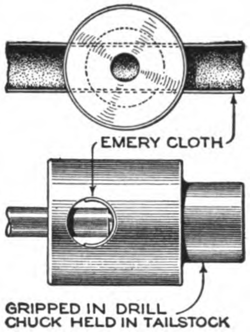


Before this form of block was made, an ordinary flat block was used, but too much time was required to get the rods straight, as they warped in different directions when struck with a hammer, and it was necessary to go over each one several times. In the case of the block shown, however, the straightened part of the rod remains straight, as it is supported in the hole, and therefore it will be quite straight after it has passed through.—Harry Moore, Montreal, Can.

ℭUse the index in the back of this book to find any article quickly.

Polishing the Ends of Pins

The appearance of pins with round or spherical ends will be greatly improved if the ends are well polished. It is a difficult matter to get a good polish by holding the emery cloth with the fingers while the work is revolved, because it is impossible to hold the cloth perfectly steady, with the result that fine grains of the abrasive cross and recross the surface, producing a scratchy appearance. To obtain the best results when using emery cloth, it should be held, if at all possible, in some kind of rigid holder of the type illustrated. A holder of this kind is merely a piece of cold-rolled steel which is turned down to a handy diameter to fit into a drill chuck. A hole of the same diameter as the work is drilled in the center, and another hole, of a diameter that will conform to the radius of the end of the pin, is drilled at right angles to and intersecting the first hole, as shown. A strip of emery cloth is inserted into the side hole and moved along as it becomes worn. This method gives a very high polish quickly and easily, and is well worth the trouble when a quantity of work is to be finished.



Skin Infections Caused by Oils and Grease

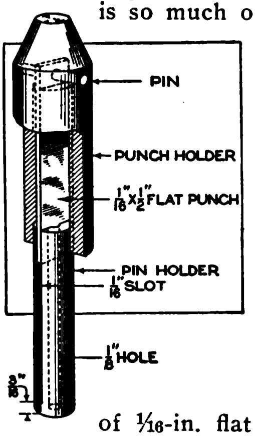
The practice of washing the hands in oil or grease, common among workmen in industrial establishments, is responsible for many mysterious epidemics of boils, eczema, and other skin diseases, according to the department of labor.

The grease or oils, as they come to the plant, do not contain any bacteria, but become contaminated after being handled by employes having pus infections on their hands or arms.

The use of gloves by workmen who handle grease is recommended, and frequent cleansing of the hands with warm water and good soap will go a long way toward avoiding trouble.

ℭA heat-resisting cement is made of equal parts of manganese peroxide and zinc white, mixed with water glass, or sodium silicate.

Driving Long, Slender Pins



A very efficient tool for driving long, slender pins that have a tendency to bend when being driven, because their length is so much out of proportion to their diameter, and also because they are not always set squarely, is shown in the drawing. The part that holds the pin is made from ½-in. steel, drilled through to accommodate the pins, and a slot is cut through to within ³⁄₁₆ in. of the end. The punch, or driver, is a piece of ¹⁄₁₆-in. flat steel, ½ in. wide, held by means of a pin in the sliding punch holder, which is drilled out, ½ in. in diameter, to within a short distance of the top. Care should be taken in making this tool to see that the flat piece fits the hole in the punch holder neatly, as this supports the driver lengthwise. When the two parts are assembled, the flat punch should slide nicely in the slot of the pin holder.

When driving the pins, they are first placed in the hole and the driver slipped over them; then, taps on the top of the punch holder will drive them home to within ³⁄₁₆ in., a final tap being sufficient to bring the pin flush with the face of the work. It will be seen that the pin is supported at all times by the holder, and that the punch holder pilots the punch down centrally, thus overcoming the two main difficulties mentioned.—Harry Moore, Montreal, Can.

A Shrinking "Kink"

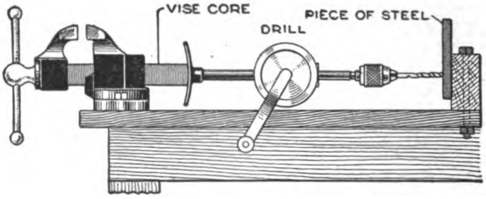
When shrinking a pulley, collar or ring on a shaft, it is well to have a shoulder to shove the ring up against for a positive stop. There are, however, cases where it is impossible to provide such a stop and where it is more a case of luck than anything else that the ring cools at the right spot, longitudinally, on the shaft. Lathe dogs are good for this purpose. The dog should be set so that when the ring butts up against it, it will be in the right location. But be careful not to put on a dog and find, after shrinking, that it is a prisoner between two rings or collars. More than one man has had to help himself out of such a hole by sawing the dog in two. Where such a thing occurs and the dog cannot be placed otherwise, use a regular split dog. It might be used in any case, for then no sawing or removing of newly shrunk pieces would be necessary.

Mirror as a Shop Tool

In many instances when a flashlight was not at hand I have found a mirror of considerable aid in doing mechanical work upon which the light of a window or other source does not fall directly. Light may be reflected, by the use of a small mirror, into telephone boxes, engine cylinders and other places difficult of access without special lighting. The mirror may be mounted so as to pivot in several directions, and fixed upon a small stand. In this form, it is especially convenient and often permits the workman the use of both hands.—Roy B. Snow, Juddhaven, Ont., Can.

A Vise and Breast Drill Used as a Substitute Drill Press

Having to drill a number of holes in pieces of ½-in. steel with no drill press available, the work was tedious. The necessity of bearing heavily against the brace of a breast drill made frequent rests unavoidable. To overcome the difficulty, a block of wood was bolted to the bench, 18 in. from the vise, which happened to be of the swivel type. The piece of steel to be drilled was then brought into place in front of this. The point of the drill was properly centered and its arm brace at the other end was placed against the moving core of the vise, as shown in the sketch. By turning the drill with the right hand and tightening the vise with the left as the drill penetrated the steel, a constant pressure was easily maintained. The holes were drilled rapidly and with comparatively little labor.—Russell Wilson, Detroit, Mich.



By Combining the Vise and Breast Drill, the Action of a Horizontal Boring Machine Was Secured

Making Small Steel Scales

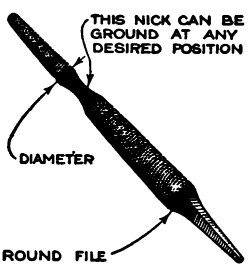
The mechanic will ordinarily profit by purchasing reliable scales or other precision instruments, but if care is taken and the satisfaction of having an accurate homemade scale, of steel, is appreciated, my experience may be of interest. I use a 2-ft. four-fold scale, accurate enough for all ordinary purposes as a pocket rule, made from corset stays, etched and polished to a finish like that of commercial steel rules. The stays are straightened, polished, and covered with a thin layer of paraffin. The indications are carefully scratched upon them, including the numerals for the inch marks. The strips are then placed in a bath of one part nitric acid, one part sulphuric acid, and 12 parts rain water, and permitted to remain until the indications are etched to a sufficient depth. The holes at the ends of the strips are located carefully and rivets placed in them, making the joints tight enough so that the rule remains extended when unfolded.—R. S. Matzen, Fort Collins, Colo.

Removing Taper Pins

When a taper pin is placed in a position where it is hard to drive out, a standard thread of suitable size should be cut on the large end of the pin. It is then only necessary to screw a nut onto this end in order to remove the pin.

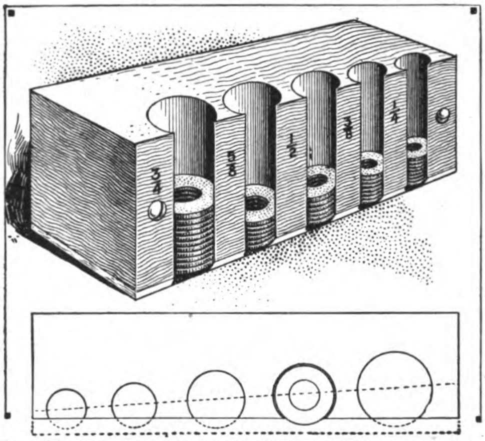
A Round File That Will Not Stick

In using a round file to enlarge a hole drilled in metal, there is always an annoying tendency of the file to stick. Besides being troublesome to pull out, the file may under such circumstances distort the hole. Where much of this work has to be done, it is a good thing to provide files with various portions smoothed down, like the one in the cut. Such a file is adapted for enlarging a hole to a diameter slightly greater than that at the point marked "diameter" on the drawing. The smooth portion provides a clearance space, to prevent the file from getting caught.—Charles C. Walderkampher, East Orange, New Jersey.



A Rack for Washers

Workmen who have frequent use for plain washers of various sizes, and who like to keep them handy so that they can be picked up and put into place as quickly as possible, may find it convenient to make a rack like the one shown in the sketch. It is made from a single block of wood, by boring holes slightly larger than the respective diameters of the washer to be used. The line on which the center for these holes is laid out should be slightly out of parallel with the edge of the block, and should be located so that the largest hole to be made will not meet either edge of the block. Then, after all the holes are drilled and a piece of cigar-box, or other thin, wood is attached to form a bottom, plane off the block, so as to expose the holes from the side. The washers can be stacked in the rack by simply dumping them in and shaking the rack about.



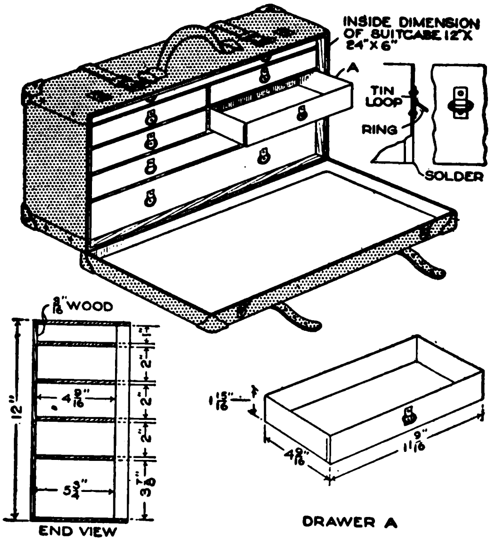
The Washers Are Always in Sight, and Cannot Rattle Loose. The Rack Is Easily Filled, and One or More Washers Are Easily Removed with the Fingers

Washing Pad for Removing Grease from the Hands

Curled hair, such as used in upholstering the finer grades of furniture, is much better than a brush for removing grease and grime from the hands. It penetrates the crevices of the knuckles and nails, and does not abrade the skin at all. To use, simply take a large handful of the hair, apply soap and wet it, then rub over the hands. It will take several days before the wad assumes the form that gives the best results, but once in shape it will last indefinitely. — Mabel Hillyer Eastman, Chillicothe, Mo.

Mechanic's Tool Case Made from a Suitcase

If the mechanic happens to have an old suitcase, he can convert it into a tool case that will answer as well as a case bought at from $7 to $10. A drawer frame, or insert, is made of 3/16-in. white wood, divided and joined as shown in the sketch. The frame is fastened in the suitcase by four small screws and flat nuts, or by copper rivets. The drawers are made of XX heavy sheet tin, soldered. A light ring is clamped and riveted to the front center of each container. The top compartment is for plans, data, delicate instruments, etc. The heavy tools are placed in the bottom compartment, and those above are for miscellaneous tools, nuts, bolts, small parts, etc. One of the compartments might be reserved for lunch. This case is very handily laid out, and should prove very serviceable to mechanics who have to travel to emergency repair jobs, and other work.—P. P. Avery, Garfield, N. J.



This Tool Case, Made from an Old Suitcase, Provides a "Place for Everything and Everything in Its Place"

Filling a Hole in a Smooth Metal Surface

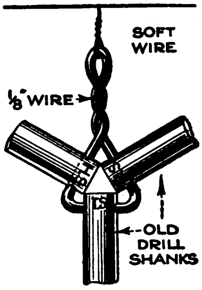
After making a surface on metal smooth by planing, sometimes a blowhole will appear which must be filled up after removing the piece from the planer. A metal plug is driven in and cut off close to the surface. The small portion projecting must be filed down level with the surface. This can be done without scoring the smooth surface by cutting a slot as wide as the diameter of the pin in a sheet of rather thick paper and placing it over the pin, the paper covering the surrounding smooth surface. While filing, the paper slides back and forth on the surface with the movements of the file. The point and heel of the file are prevented from scoring the smooth surface. —Donald Hampson, Middletown, N. Y.

How to Sharpen Old Files

A method to sharpen old files that has proven quite satisfactory, although it is rather odd, is to clean them of all grease and foreign matter and suspend them from a metal plate by a piece of bare wire, in a bath of three parts of sulphuric acid, six parts of nitric acid and 100 parts of water. Several plates of carbon should be immersed in the same bath and connected by bare wires to the metal plate supporting the files. The cavities in the file are eaten deeper, and the edges are made almost as sharp as if worked by a file cutter.

Testing Steel on Emery Wheels

Arguments often arise in the shops as to what particular type a certain piece of steel belongs. It is generally known that each kind produces a spark peculiarly its own, when touched on an emery wheel; but what these sparks are like, and to which kind of steel each belongs, is not so easily remembered by everyone. The three most commonly used steels—machine, tool, and high speed—can usually be recognized if the material is new, but if it is old, or has been used previously on other work, it is hard to judge just what it is without testing in some way. A good practice, to avoid mistakes, is to keep samples of each at hand. The illustration shows a simple method of doing this, which possesses the all-important feature of keeping the pieces together. Two old drill shanks, one of high speed, the other of tool steel, and a scrap piece of machine steel, have a 1/8-in. hole drilled through one end, and are stamped HS, TS, and MS respectively. The pieces are forced onto a 1/8-in. wire, which is then bent to a triangular shape

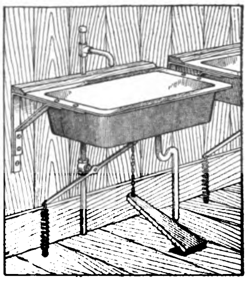


to keep the pieces well apart, and twisted together, leaving a loop at the top. A length of soft wire is attached to this loop, the other end of the wire carrying a weight, and the whole thing fastened under the bench where the grinder stands, by two staples. In this manner it is kept out of the way when not in use. When it is desired to test a piece of steel the test pieces are pulled forward and touched on the wheel, while the piece to be tested is touched on the other side. In this way it is obvious to the most unskilled, by comparing the sparks, what kind of steel is being tested.

Brass Box Corners Made of Square Tubing

Attempts to make corners with which to reinforce boxes, or other constructions, usually result badly when they are made of sheet metal bent from a flat piece. A better method is to obtain square tubing of the proper size and to cut off opposite corners. When the cut edges are filed smooth and the corners fitted into place they will give strong reinforcement, since tubes of this kind are accurate in cross section and their corners are square without rounding at the angle.—B. E. Dobree, Battleford, Sask., Can.

Foot Control Handy for Faucets in Washbowls

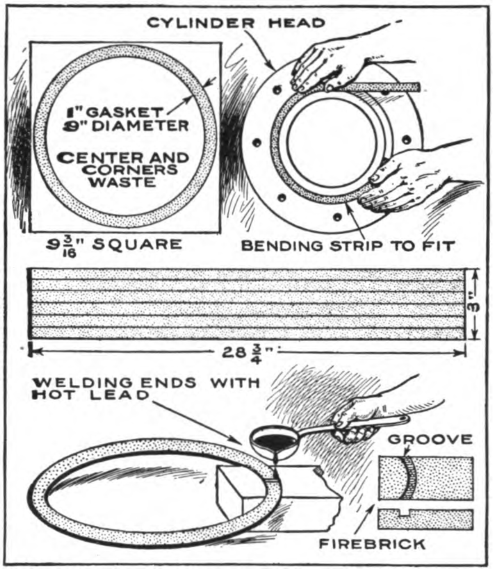


Foot control for the washbasin is recognized as the most convenient and sanitary method, and its adoption would be much wider than it is, if its advantages were better known. It will contribute wonderfully to the cleanliness and convenience of the shop washbowl, if a pedal is installed so that pressure, applied to it with the foot, turns on the water, it being turned off by a spring, when the foot is removed. In this way, the convenience of a steady stream of water is secured, while at the same time all danger of the water being left turned on by a careless person is eliminated.

¶If rubber is put under the legs of shop benches it will deaden the noise from hammering on the top.

Making Lead Gaskets

Lead gaskets, for cylinder heads and similar joints, can be cut from sheet lead without waste by a method different from the usual one, which wastes approximately 90 per cent of the total sheet, although the gasket is made in one piece. The illustration shows the difference in economy between the two methods. A piece of sheet lead, 9 3/16 in. square, will only yield one 1 by 9-in. gasket, cut by the older method, and, although the center may be used for smaller gaskets, many times it is not. A rectangular piece, 3 by 28 3/4 in., which is of approximately the same area as the first one, will, by cutting strips as shown, yield three 1 by 9-in. gaskets; or six 1/2 by 9-in. ones, with practically no waste.

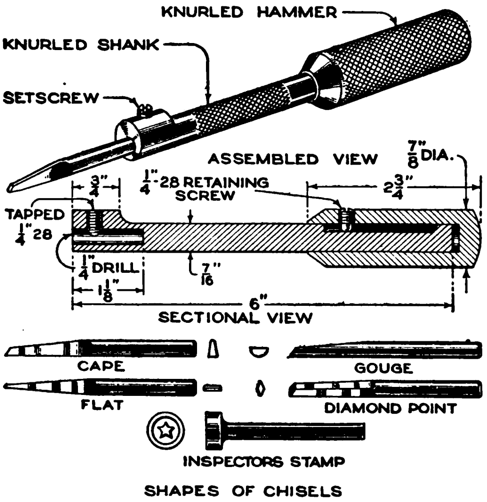


Forming Lead Gaskets from Strips of the Proper Width and Length, Results in Perfect Gaskets, and an Economy in Sheet Lead of Approximately 90 per Cent

The strips are easily bent around the flange, as shown, and the ends are clipped off to leave a gap about 1/8 in. between the ends. A firebrick is grooved out with a chisel to conform to the arc of the gasket; this is for the purpose of holding the ends in their proper relation to each other while melted lead is poured into the joint. It is best to smear a little soldering paste over the ends before pouring the melted lead, as this makes a better-knitted joint. The joint is afterward dressed down to the same thickness as the remainder of the gasket. Gaskets as small as 2 in. in diameter can be made in this manner.—J. V. Romig, Allentown, Pa.

Self-Contained Hammer and Chisel

There is nothing quite so unhandy to hold and work with as a small chisel. Many and hard are the knocks the workman receives on the fingers and knuckles when chipping in confined places and difficult corners. Even on work easily reached by hand, it is a ticklish job to chip a slot or small keyway if the chisel must be held by hand. The "hand gun" illustrated was designed to overcome this, and is extensively used on fine tool and die work. With it, there is less abuse of the tools, and by using bent and shaped chisels, some work can be done that would otherwise be considered impossible.



A Combination of Hammer and Chisel That Makes Chipping and Tooling in the Confined Corners of Tool and Die Work Comfortable

The shank of the tool is made of drill rod, turned to the dimensions shown, the center is knurled for a good grip, and a flat is filed, or a groove cut, near the rear end. The hammer sleeve slips loosely over the end of the shank, on which it is retained by a small screw; this part is also knurled and has a polished round end.

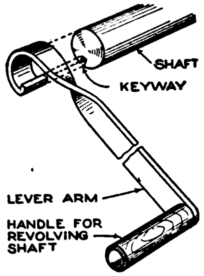
In use, the chisel is fastened in the head, and the shank of the tool is held by the left hand. The sleeve is drawn back, and then brought sharply forward, with the desired degree of force. Any weight of blow can be obtained, though for light work it is sometimes desirable to provide a smaller and lighter hammer sleeve. The chisels are made of ¼-in. drill rod, ground or filed to shape, and of various widths and sizes to suit the work in hand. Inspectors' stamps can also be made up to fit the tool, and, so used, will save time and trouble. Commonly, either the stamp or the hammer is mislaid, and holds up the inspection; with both combined into one tool, this is not likely to occur.

To Prevent Wingnuts Falling from Bolts

Wingnuts are exceedingly handy devices for providing a convenient way to make attachments that are easily and quicky undone, but they are very much inclined to work themselves off the threads on account of the balancing of the wings. This is especially true where they are used to fasten the valve-mechanism covers on automobile engines. It is a simple matter, however, to keep them on the thread, even though they become loosened, by removing one of the wings. The single wing may drop half a turn at most, by gravity, but there will be no possible way for the nut to jar itself off. The removal of one wing does not interfere with tightening or loosening the nut with the fingers.—Stanley P. McMinn, Brooklyn, N. Y.

Handle for Rotating Shafts

The shop mechanic often finds it necessary to rotate the shafts of a motor, engine, or other machinery upon which he is making repairs. This operation may be accomplished with ease with the aid of a detachable lever or crank. For shafts under 1 in. in diameter, it is suggested that the lever arm be made of mild steel, 3/16 by 1 by 12 in. At one end a suitable handle is made, its axis being perpendicular to the 1 in. surface. At the other end, the steel strip is given a half twist, and the 1-in. width is formed around the shaft, as shown, the extreme tip of the strip being bent in to catch in the keyway of the shaft. To turn the shaft it is only necessary to slip the curved hook of the handle over the end of the shaft so the tip will engage with the keyway, and turn as if cranking an automobile. This is an excellent tool for inspectors; they can thus easily rotate the movable parts so as to make a thorough examination. It is apparent that this will be a good tool for a machinist to add to his kit.

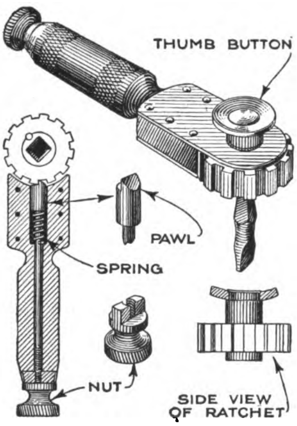


Gauge Determines Diametral Pitch of Gears

The simplicity of this gear-pitch kink, that I have worked out, will appeal to a large number of mechanics, and others who have occasion to send a helper to get the pitch of a gear, in a position where it cannot readily be measured or taken down. Obtain a piece of sheet metal, about .008 in. thick, ½ in. wide, and 3.1416 in. long, and bend it to the circumference of the gear on the pitch line. The teeth between these two points will be the diametral pitch. The explanation is that the diametral pitch is the number of teeth to each inch of the diameter of the gear; therefore, if a gear has, for example, four teeth for an inch of diameter, those four teeth cover a space on the pitch line of 1 in. multiplied by 3.1416, and that is the length of the gauge.—Robert D. McElvany, Norfolk, Va.

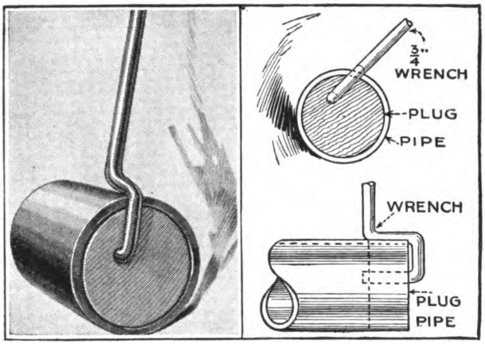
A Ratchet Screwdriver for Confined Places

Having often experienced difficulty in removing screws from narrow and shallow places, and finding the usual bent screwdriver unsatisfactory, I devised a simple and easily made ratchet tool for work of this character. I flattened one end of a piece of ½-in. round steel, and drilled it through the center, one end being counterbored to accommodate the pawl and its spring. Three small holes were drilled on each side of the flattened portion for riveting two sheet-iron pieces, which serve as bearings for the ratchet wheel. The ratchet is made from 1-in. round stock, with a square hole at the center to hold the square-shank screwdriver bit. A thumb button is riveted to the top of the ratchet wheel, holding the tool to the work. By pulling out on the nut and giving it a half turn, the direction of rotation can be changed at will.—J. Magis-Frankhart, Ouffet, Belgium.



Wrench for Turning Large Pipe

The wrench shown in the illustration can be made in a very short time, and is of great value when one is confronted with a job requiring the use of a large pipe wrench, a tool that is usually not carried in the mechanic's tool box.



A Simple Wrench, Consisting of a Lever and a Wooden Disk, Makes a Good Substitute for a Large-Size Pipe Wrench

It consists of a lever made of ¾-in. bar stock, bent to the shape indicated, and a wooden disk that fits loosely in the end of the pipe and has a hole drilled through it, off center, to fit the end of the lever. The manner of using the tool is obvious from the illustration.

Revolving Tool Rack

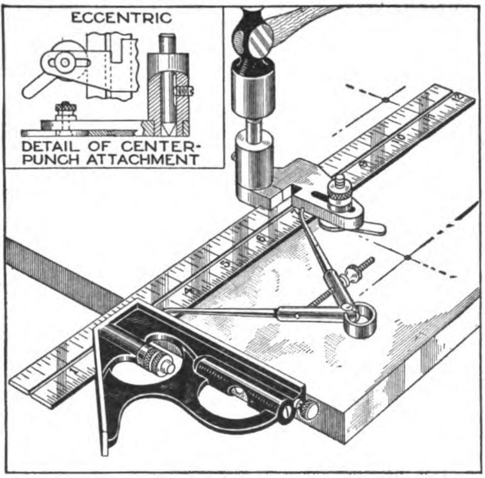
In small shops, or other places where it is desirable to economize tool space, a revolving tool rack may be installed to advantage. A round rod is set into a plate fixed on the bench, and its upper end supported by a metal brace, fixed to the wall. Two round wooden disks, with holes for the tools, are supported on the rod, and may be revolved to make access to the tools convenient. Metal disks may be used, and will be more serviceable than the wooden ones.—H. W. Offins, Grants Pass, Oreg.

Holding a Bolt in a Turning Crank

A bolt and nut may be held in the end of a turning crank or shafting by the following method, which seldom fails, even though it is inclined to work loose. Before inserting the screw place a small block of wood in the hole. When the screw is turned up tightly against the wood, the revolving motion of the machinery will not cause it to work loose. —Loren Ward, Stockport, Iowa.

Center-Punch Attachment for Square

The attachment illustrated will be found a timesaver when laying out work. By setting the index mark on the attachment to a graduation on the square blade, any desired distance from the edge of the work can be prick-punched instantly; for greater accuracy, a pair of calipers, or an inside micrometer, can be used in setting.



A Center-Punch Attachment for the Combination Square That Will Be Found Very Useful on the Laying-Out Bench

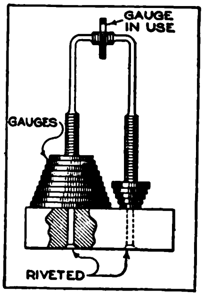
The base of the device, which is made of tool steel, is machined with a shoulder that fits against one edge of the square blade; a slotted extension opposite this shoulder carries a cam or eccentric that locks the attachment in place. The slot, and the construction of the cam stud, enable the attachment to be used on blades of varying widths. The punch is carried in a sleeve, forced into a hole in the shouldered end of the base; in line with the punch point, an index mark is cut on the base, and the edge of the slotted extension is milled or ground exactly in line with the punch point also. A flat, filed on one side of the punch, and a small setscrew in the sleeve, prevent the punch from dropping out.

Repairing a Flexible Shaft

Clean both ends of the shaft which are to be joined together with gasoline, to remove all grease, oil and dirt. Secure a piece of brass tubing about 4 in. long, no less than 1/32 in. thick, and a trifle smaller in diameter than the shaft. Split the tubing with a hacksaw all the way down one side so that, when the ends of the shaft are inserted in the tubing, it will expand and make a tight fit around the shaft. Place one end of the shaft in a vise and fasten the other end on a block of wood, making the part to be joined level and rigid. Heat the joint with a blowtorch, being careful not to draw the temper in the brass tubing or shaft. When the joint is hot, pour melted babbitt metal in through the split in the brass tube until the babbitt sweats itself thoroughly into the ends of the shaft and fills up the seam in the tube. The babbitt must be heated until it chars a piece of wood when dipped into it. Dress the joint with a file, and it will be found to work perfectly. As many as four joints of this kind have been made in one shaft, 7 ft. long, with satisfactory results.—J. O. E. Dieterich, New York City.

A Radius-Gauge Holder

A handy set of radius gauges and a convenient holder for them are shown in the drawing, the latter being designed to suit a set of gauges of radii from .160 in., increasing by .025 to .535 in. At first the disks were strung on a chain, but as one gauge would be used for a considerable time for inspection purposes, the others were in the way, and as it was not desired to separate them, as a safeguard against loss, the holder shown was worked out. This holder keeps all the gauge disks together, and the one in use is in a handy position when inspecting the work.



The gauges are made from 1/16-in. stock and tapped at the center; a piece of 3/32-in. wire is flattened out for a short distance near each end and at the center, and a die, the same size as the tap used for the gauges, is run over the flattened portions. The wire is then bent as indicated, with the gauges threaded on one side, starting with the smallest and up to the largest, forming a cone. A base is made from a piece of flat steel, and drilled with holes to take the ends of the wire, which are then riveted in place.

It will readily be seen that to use a certain gauge those above it are twirled off one side of the threaded wire and over the central portion to the threaded portion on the opposite side. The gauge wanted is left on the central threaded part, where it can be used without interference.

To Hold a Cap Screw

Machine designers usually call for the use of through bolts instead of cap screws wherever possible. The ordinary cap screw, or tap bolt, has a habit of working loose which is often disastrous in its results. There is no chance to put a nut on the "far" side to lock it, and if used in cast iron, the average tapped hole is of such size that it makes a loose fit for the screw which soon jars out. If it is set up tightly, the screw is strained beyond the safe point, or it is twisted off.

Various methods have been employed to keep tap bolts in place, but one that can be worked without preparation or expense is as follows: A split washer, now so familiar to the automobile trade, is put under the head before screwing it down. These washers are made of special spring steel, split and given a twist, then tempered. The twist, when flattened out, puts a constant tension on the cap screw, and in many cases will be the means of keeping a screw tight, just as it keeps a nut tight. Its cheapness and general availability make it a valuable aid.

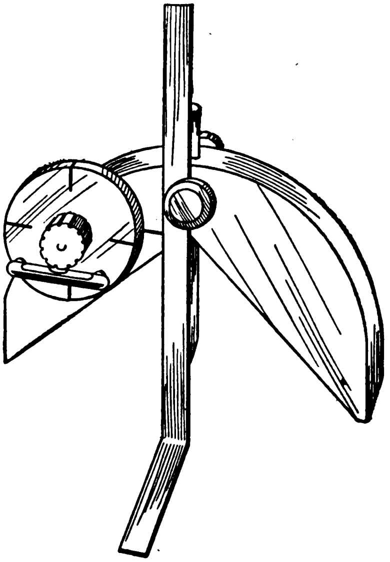
A Center Square

The body of the center square is shaped from a piece of metal, about ½ in. thick, and a perfect right angle is cut in it, as shown. Exactly in the center of the corner, drill a 3/16-in. hole for a center punch, which is made of steel and hardened. An L-shaped piece is fitted in one side, so that one of its edges will exactly center the intersection of the angle. The extending L-portion should be carefully turned out at right angles so that its edge will be at exact right angles to the face of the body. The piece is clamped in place with the head of a bolt whose body is drilled to admit the center punch. Both the punch and the L-shaped piece are clamped with the same bolt.

A disk is fastened with a knurled-head screw to one arm of the main part. A level is fastened on this disk at one side of the screw. The disk has four marks evenly spaced, quartering it. The level should be accurately set so that the markings will register level when the angle in the body is perfectly vertical

It will be readily seen that, when the level bubble registers level, a line can be drawn on the end of the shaft perfectly vertical on its diameter, and that, by giving the disk a quarter turn, a line can be drawn perfectly horizontal, or at right angles to the vertical line across the diameter.

If, for some reason or other, the shaft is taken out of the clamps, and it is then desired to work on it again, clamp it down as before, and set the center square on top of it. The shaft can be set up by letting the center punch touch the line already scratched, and it will bring the shaft up level as before.



Center Square for Marking Round Stock to Locate the Center and to Lay Out Keyways

Special-Size Thumbscrews Made Quickly

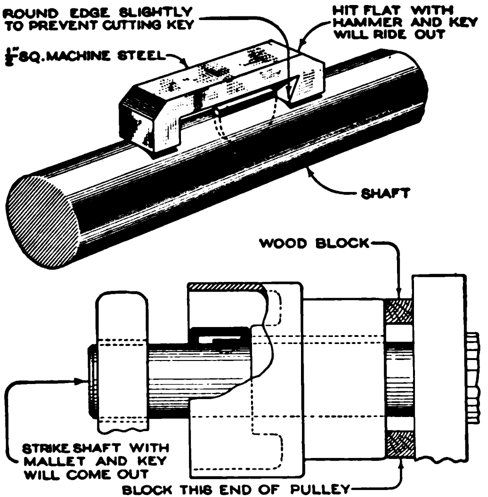
Requiring several thumbscrews of a special size, I devised the following method of making them: Ordinary fillister-head screws of a size to fit the work were used. A piece of sheet metal was driven tightly into the slot in the head and cut to the proper shape. The edges were filed and smoothed with emery cloth, and the screws proved satisfactory both as to appearance and use.—Monroe D. Dreher, Newark, N. J.

¶Bronze bearings may be cleaned with a solution of washing powder and water run through the oil cups while the machine is running without any load. The solution, cutting out the dirt and grime, will come from the bearing very black. About 1 pt. of this mixture should be run through each bearing, then clean thoroughly with clear water. This makes a bearing and axle smooth and clean.

Tool for Removing Woodruff Keys

A tool which will remove a Woodruff key from a shaft into which it is tightly fitted is shown in the drawing.

The tool is made from ½-in. square machine steel, bent and formed as shown; on an exposed key it is used as shown in the upper half of the sketch. The lower sketch shows the tool in use where the hammer cannot be used directly. Small blocks of wood, of the proper thickness, are placed behind the pulley, which is slipped back until the blocks come against a shoulder on the machine, leaving just enough space between the pulley and key to insert the tool. A few blows on the end of the shaft will then remove the key. —F. K. Ladd, Bellows Falls, Vt.


ROUND EDGE SLIGHTLY TO PREVENT CUTTING KEY
HIT FLAT WITH HAMMER AND KEY WILL RIDE OUT
½" SQ. MACHINE STEEL
SHAFT
WOOD BLOCK
STRIKE SHAFT WITH MALLET AND KEY WILL COME OUT
BLOCK THIS END OF PULLEY

A Simple Tool That Makes the Task of Removing Woodruff Keys Easy

Mechanics' Hand Cleaner

Sawdust, saturated with kerosene, makes a good hand cleaner for mechanics. The oil-soaked sawdust should be kept in a covered metal container to prevent possibility of fire from spontaneous combustion.

How to Repair Steel Tapes

The ends of the tape left by the break must be straightened out with a pair of pliers and joined together, end to end, so as to leave the length unchanged. Bend a strip of tin ½ in. wide around the joint and clamp it down firmly with the pliers. Put a few drops of soldering acid solution and a small piece of solder on the joint; hold over a burning candle or any small blaze until the solder melts. A small pine stick may be used to spread the solder and make it run into all the seams.

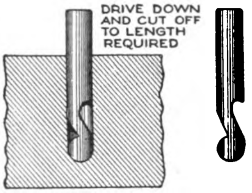
A field repair outfit to be carried in a civil engineer's transit or level box is made up of a vial of soldering acid, solder, a small pair of steel pliers and a few old tin can seals. The soldering acid can be made by dissolving zinc in muriatic acid to saturation. With these conveniences a civil engineer can keep his tapes in good repair.

Machine Nuts Set on Rods with Belting as Wrench

A large stock of iron rods, with threaded sections at each end, were to be fitted with two nuts at each threaded part. The nuts were to be turned down firmly preparatory to shipping the rods. To save time, I started the nuts on the threads by hand, and then set them quickly by the use of an old piece of belting, 3 ft. long. The rod was gripped in a vise, and the belting looped over the nuts near one end of it. By drawing the belting quickly around the nuts they were turned up snugly with a single motion of the belting. To have done this work with a wrench would have taken much more time.—H. G. Corbin, St. Paul. Minn.

Fitting Pins Tightly in Oversize Holes

When a pin must be made tight in a blind hole, and this is a trifle larger in diameter than the pin, it is quite a problem to make the pin hold. It may be done by flattening the pin with a hammer, or sometimes by wrapping a piece of very thin sheet steel around the pin—this being a very bunglesome way. The illustration shows how it may be done so as to hold firmly, and show no external evidence that there is a "bad fit." The method is merely to file two large notches in the pin, in about the position shown, and then drive it in tight. The pin takes hold like an expansion bolt.—Joe Cowles, Columbus, Indiana.



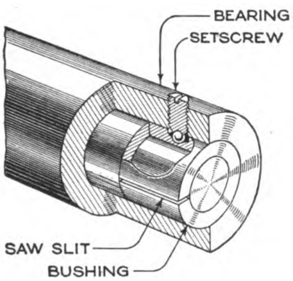
ℂWhen no pencil is at hand, a substitute may be made by pointing a piece of wire solder and using it as a pencil.

Canvas Tool Bag

Electricians, carpenters, automobile-repair men, and other mechanics will find the tool bag described convenient, although it was designed for use by car inspectors in railway service. The frame is made of 1/16 by 3/4-in. brass, or galvanized-iron, strips, covered with 10-oz. canvas, and supported by a 2-in. leather shoulder strap. The frame is reinforced across the ends by similar metal strips, and No. 12 copper rivets are used in fastening the material throughout. The cover is kept in place by a buttoned strap, and extends 1/2 in. beyond the ends of the bag at the portion below the fastenings of the shoulder strap. The shape has been found convenient for the special purpose for which the bag was designed, but this may be readily adapted to the carrying of special tools, or even material.—Joseph K. Long, Renovo, Pa.

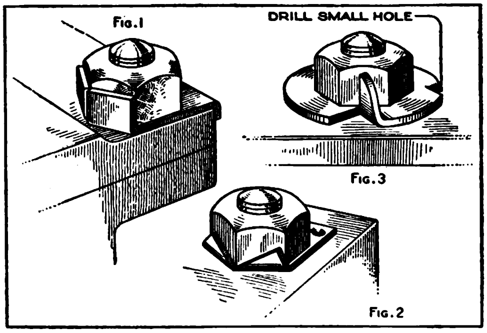
Taking Up Play in Solid Bushings

Frequently, when the solid bushings of machine parts become too worn, they are discarded and new ones fitted. In cases where it is found impossible to get new bushings at once, a handy way to "doctor up" the old ones is shown in the drawing. A hole is drilled and tapped in the journal box right over the point of greatest wear, where the bore will be oval, in line with the pull of the belt. Allow the drill barely to spot the brass, and use a bottom tap to finish tapping the hole. After this operation, the shaft being withdrawn, slit the bearing with a hacksaw blade, holding the saw with the fingers if the frame cannot be used. Then drop a 1/16 or 1/8-in. steel ball into the hole, and screw in a cup-pointed setscrew. Pressure applied to the bushing by the screw will enable the worn part of the bearing to be brought into contact with the shaft and take up the play. The ball fits nicely between the bottom of the setscrew and the bottom of the hole, and keeps the bearing from turning. Where the bearing bushing is long, place two or more such screws along its length.



Easily Made Lock Washers

These three types of lock washers are the invention of a practical mechanic; each of them has been tested and found efficient. They have the advantage of being both cheap and easy to make. In Fig. 1, the washer is cut oblong, the hole is drilled in the center, and one end is split and spread. This washer is slipped on, and the two tabs are bent up against the flat sides of the nut, while the other end is bent downward over the edge of the part held. Fig. 2 shows a common square washer, made of 1/16-in. sheet iron. When washer and nut have been tightened down, a prick punch is driven into two corners, and the other two corners are bent up against the flats. Fig. 3 is a common round washer, slotted as shown with a hacksaw. A small hole is drilled in the work in any place at the edge of the washer, and a section of the washer is drifted into this hole. The larger lug is turned up at right angles, so that it bears against the nut.



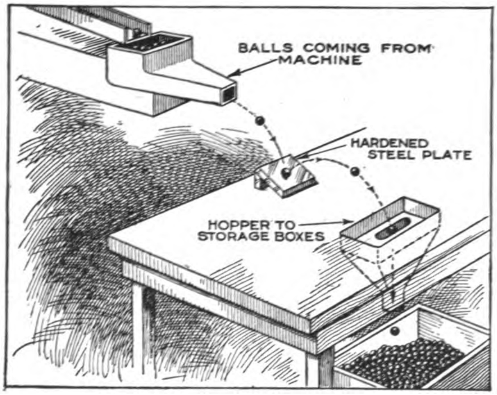
Three Types of Lock Washer Which Are Easily Made and Useful in Machinery Which Is Subject to Vibration

Oil Cups Remodeled to Adjustable Feed

A number of plain oil cups were changed to a satisfactory self-feeding type at little expense as follows: The hinged cap of the oil cup was tapped for a 5/16-in. cone-pointed setscrew, and a locknut applied to prevent the screw from jarring loose. This screw acted as a needle valve, seating on the edge of the small hole in the bottom. A hole for filling the cup was drilled through the cover, and the latter was then sweated fast. A feed as slow as one drop in ten minutes was obtained, and when once set for its particular purpose, the valve needed no further attention.—D. A. Hampson, Middletown, N. Y.

Automatic Testing of Steel Balls

A factory received an order for a large quantity of hardened steel balls, the contract specifying a certain degree of hardness. As the time was limited, it would have been impossible to run each ball through a testing machine, but after a little testing and experimenting with perfectly hardened balls, the device shown in the drawing was rigged up, and the balls were tested automatically as they came from the machines. The finished balls ran from the machine to a funnel-shaped spout, the outlet of which was slightly elevated, and just large enough for one ball to come through at a time. The ball, on coming out, naturally described an arc in falling onto a hardened steel plate underneath the spout, as shown. On striking this plate the correctly hardened balls bounced off into a tray, sunk flush with the bench, but, if they were too soft, they would not bounce far enough to enter the tray and, if they were too hard they would bounce too far. Thus, only the perfect balls fell into the tray.—J. H. Moore, Toronto, Ont.



Correctly Hardened Balls Bounce into a Chute; Imperfect Balls Bounce Too Far or Fall Short of the Hopper

Sharpening Tools with Mill File

That a fine flat mill file may be used for sharpening and dressing tools is a fact that many mechanics have overlooked completely. Possibly it is not generally realized that the edges of scissors, tinsnips, screwdrivers, and numerous other tools, are softer than the file and can be dressed down to a sharp cutting edge. It is advisable to keep an old file with a broad surface for this purpose, and use it by clamping the tool to be sharpened in the vise. Occasionally a tool too hard to file will be met with, and for this reason the use of an old file is advised. In sharpening scissors, especially when used for cutting cloth, the file-sharpened edges are better than oilstoned ones. The file marks should run downward and inward on both cutting edges; the wire edge left by the file is removed by simply closing the scissors as in cutting.

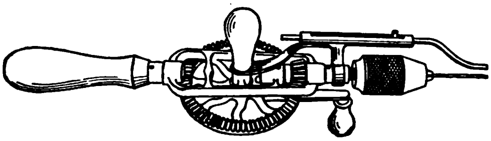
Balancing Pulleys

High-speed pulleys must be balanced. In the case of a solid web pulley this is easily accomplished by finishing it all over, but one having arms cannot be balanced in the same way. Such a pulley must be placed on an arbor, centered in a lathe and the side that turns down marked. Putty is then placed on the opposite side—or on two spots 120° apart—until the pulley balances well. Weigh the putty, cut off pieces of steel of equal weight and rivet them to the inside of the rim.

A pair of balancing ways are better than the lathe centers. These are made by fastening narrow strips of metal on the tops of two horses, placing them so that the arbor rests on each, and leveling the strips with a spirit level. This method produces little friction and a very close balance can be attained.

A Support for a Breast Drill

It often occurs that the drill point of a breast drill breaks, especially if it is small, and hard material is worked. This difficulty seems to be effectively overcome by attaching to the drill the device shown herewith. It consists of a clamp having in its upper flattened end a slot through which the handle of the drill is inserted and screwed tightly, and at a lower point a screw clamp fitting just above the drill chuck. In a sleeve, in one piece with or otherwise attached to the clamp, slides a rod, the movement of the latter being controlled by a spring within the sleeve. The rod forms a second support for the drill and as the latter penetrates into the material, the rod is backed up into the sleeve, while the spring, acting contrary

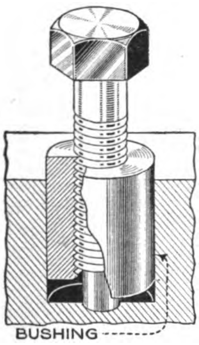


The Support on a Breast Drill for Preventing the Breaking of Small Drills to this motion, holds its end firmly against the work or some surface beside it. The vibration of the drill bit, which is the cause of breakage, is eliminated by this double support.

Holder for Marking Punches Strapped to Workman's Belt

Especially in the machine industries, it is a common practice to mark various parts before assembling them, and the workman who does this must go from place to place with his set of steel marking punches. It is unhandy to carry these in the box usually provided, and a wide-awake mechanic rigged out a harness-and-belt arrangement, which proved to be very convenient. He made a curved piece of wood to fit the body at the waistline and attached the straps to it. The punches are carried in holes in the wooden piece, and are handy to get at.—C. C. Spreen, Flint, Mich.

Removing Bushings from Blind Holes

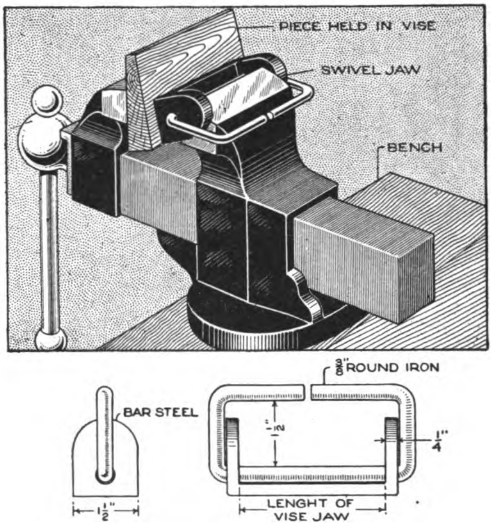


Although it is easy to install a bushing in a blind hole, its removal is an entirely different matter. The shopman is frequently called upon to remove such a bushing, and the method described may help when he meets with an obstinate case. The bushing hole is first tapped, using a bottoming tap, and running it down to the bottom of the hole; this will thread all but a very small length of the bushing. An ordinary bolt with the same size thread as the tap is turned down or filed so that a portion of the end is smaller than the bore of the bushing. By screwing this bolt into the threads cut on the inside of the bushing, the end of the bolt strikes the back of the hole and the bushing is forced out. If the bolt screws into the end of the thread before the bushing is entirely out, the bolt may be removed and a small block placed below; this will usually give enough additional purchase to finish the job.

¶A good bushing for sheave wheels, pulleys, etc., can be made of a piece of brass tube.

Swivel Jaw for Holding Wedge-Shaped Articles in Vise

Wedge-shaped or beveled-edge articles are usually difficult to clamp in a vise for the reason that one side of the vise jaws will not rest squarely upon the surface. Absolute security may be had in the clamping of such articles with the aid of a swivel-jaw attachment, as illustrated. The jaw is cut to the shape indicated from a piece of bar steel and is hooked over the permanent vise jaw with a 3/8-in. iron link, as shown. The dimensions of the swivel jaw are of course determined by the size of vise in connection with which it is to be used. It may be knurled on the clamping surface or left smooth as requirements demand.—C. C. Spreen, Flint, Mich.



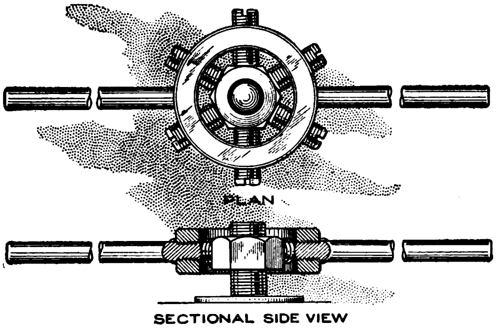
With the Swivel-Jaw Attachment for a Vise a Wedge-Shaped Article May Be Clamped as Securely in an Ordinary Vise as if the Surfaces Were Parallel

Cutting Teeth in a Rack by Hand

A workman, having a rack to cut on the edge of a piece of steel about 12 in. long, had no machinery at hand other than a lathe. The rack required 12 teeth to the inch and as they did not need to be accurate, he intended to file them in. But he did not like to mark out the 144 spaces. Therefore he put the piece in the lathe, geared the machine to cut 12 threads to the inch, and nicked one edge of the piece for its whole length. The piece was set a little off the center so that only one side was marked. This plan might be applied to other jobs.

A Novel Adjustable Wrench

A type of homemade wrench, which has a wide range of adjustment by means of screws set in a ring, as shown, was made as a novelty, and proved quite useful. Three of the screws can be used at a time for handling one size of hexagon nut, and the others adjusted for another size. Two opposite screws will grip a surface nut, and an octagonal nut can also be held tightly. The screws are loose enough so that they can be turned with the fingers, and are set when necessary with a screwdriver. In this way the wrench can be clamped to the nut.—J. Prophet, Pittsfield, Mass.



This Wrench, Made as a Novelty, Proved Quite Useful

Holding a Water-Pump Gland Nut

The gland nut which held the piston-rod packing on a water pump caused considerable trouble in constantly coming loose. This was due principally to the constant vibration, and also to the worn-out condition of the threads. A new nut was purchased, but the thread on the cylinder was found to be the one worn out, so this did not relieve the trouble. Two ordinary headless setscrews were then tried out with success and the trouble was eliminated.

Removing "Frozen" Bolts

Owing to rust, or the end of a bolt being riveted over the nut, bolts in the chassis of automobiles frequently resist all efforts to start them with wrenches, and sometimes they are so located as to prevent the use of a chisel or drift on the nut. A simple method for removing such bolts is to drill through the bolt head down into the body of the bolt. Make a punch mark in the center of the head, and use a drill slightly larger than the diameter of the bolt body; if an air or electric drill is used, the bolt will be out in a comparatively short time. In any case the drilling method is better than cutting the head off the bolt, as there is no possibility of a flying bolt head striking and injuring anyone, breaking a window, or doing any other damage.

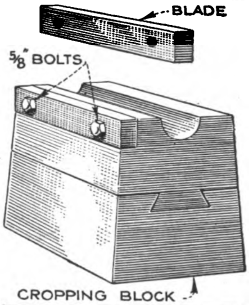
A Preventive of Grimy Hands

A thorough scrubbing will not remove the grime and dirt that seem to work right into the skin on the hands when handling some makes of electric wires or working about machines that are covered with oil and dirt. A correspondent uses a coating thoroughly rubbed on the hands before starting to work which prevents the grime from entering the pores of the skin. The preventive consists of 4 oz. of grain alcohol, 3 oz. of glycerin and 3 oz. of water. The mixture quickly dries on the skin, and after work a washing with soap and water will quickly remove all the dirt.

Economizing on Cropping Blocks

It is a general practice in steel manufacturing plants to crop bars of steel before straightening them. This is done on a cast-steel cropping block, and when the edge of the block becomes rounded or chipped, which is caused by heavy cropping, the block is machined down to form a new edge.

An improvement on the ordinary block is made by rabbeting the edge of the block as shown, to a depth of 2½ in. and a width of ¾ in., to form a seat for a removable tool-steel blade which is bolted to the block. The four edges of the blade can be used, and, when the last edge is worn, a new blade can be substituted for the old one. The holes in the blades and the block are drilled 2 in. from each end, and exactly on the center, so that the blade will fit the block and holes exactly in either position. The steel used for the blade should be 80-point carbon tool steel, with a Brinnell hardness of 477.



¶A shaft bearing will take only so much oil, and it is a waste to use more.

Repairing Worn Threads by Electroplating

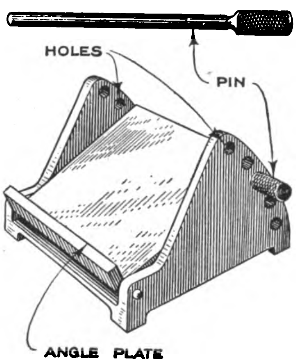
The threads on a compression screw spigot became worn to such an extent that the compression part would no longer hold the spigot in place. A new spigot was of no use, owing to the worn thread. To avoid expense and inconvenience the following expedient was adopted. A copper strip, about 1 ft. long, was soldered to the spigot, and the outside of the latter and about 6 in. of the strip thoroughly covered with asphaltum varnish. The spigot was hung in an electroplater's bath and given a coat of copper plate. A gauge or template was made to test the deposit so that it was reduced to the correct diameter. The job was a perfect success.—Frank D. Henry, Haddon Heights, N. J.

Hinged Drawer Front Is Convenient

A large drawer in a bench was used for tools of various sizes, and it was difficult to remove those placed in the back of the drawer. As a result most of the tools were placed in the front part, often making it inconvenient to open the drawer. The front of the drawer was arranged to swing forward on hinges, and compartments were provided so that the tools had to be put in carefully. This increased the usefulness of the drawer and made it easier to get at the tools.—Charles C. Brabant, Detroit, Mich.

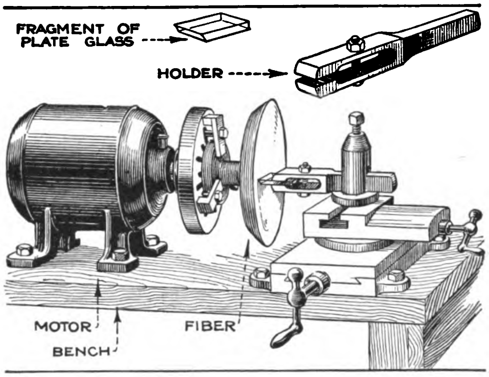
An Adjustable Angle Plate

The angle plate shown in the drawing differs from the fixed angle commonly used, in that it can be adjusted to meet varying requirements. Holes are provided in both end members of the base, and a pin, having a knurled head, is inserted into the hole, giving the desired angle. This plate can be used on any class of drilling or boring work, and is a valuable timesaver. It is not at all difficult to make.



Turning Hard Rubber

Anyone who has had experience in turning hard rubber, ebonite, and bakelite, knows how difficult it is to keep the edges on the steel tools, and to produce a finely burnished surface. The tool dulls rapidly, and drags the surface of the material, so that the work presents a ragged appearance.



Method of Cutting and Facing Hard Rubber with Pieces of Plate Glass

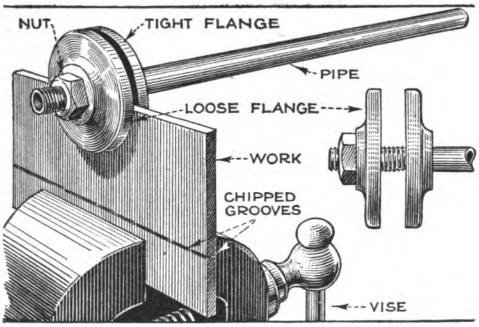
The difficulty can be avoided to a great extent by using a small piece of plate glass as a cutting tool; this has been found to give excellent results, both in cutting and in surfacing the work. The piece of glass is clamped in a toolholder of the design illustrated in the upper detail. The cutting edge is obtained by fracturing the glass; when this is dull a new break is made. Pieces of heavy glass broken from bottles can also be used but cannot be held so easily in the toolholder.

Care of Wheel-Truing Diamonds

Take only light cuts with the diamond, and as the stone wears, turn the nib in the holder to insure uniform wear; then when the stone wears down to the metal setting, reset the stone so as to expose a new cutting surface. When the diamond is worn down to a small size, reset it in a holder, and use it in the tool room. Be careful not to jam the diamond into the wheel, and instruct operators not to allow the stone to get any violent knocks, as it is very hard and therefore brittle. Never use a diamond dry, except on small wheels for internal grinding, or on tool or cutter wheels; on large wheels for cylindrical or surface grinding, direct a copious stream of water on the diamond at the point of contact with the wheel.

Breaking Off Iron Plate

A favorite method of separating a piece of iron plate from the main stock is to chip a groove along a line drawn to the required shape, and afterward to break the piece off by wrenching it or striking it with a hammer. This, however, often results in bending the piece, which makes it necessary to flatten it out again before it can be used.



A Handy and Time-Saving Tool for Breaking Off Pieces of Iron Plate without Bending Them

In one shop where a great deal of this kind of work was done, the method shown in the illustration was found to be very convenient and to save considerable time, as with it, plates could be broken off without bending. The tool consists of a length of iron pipe threaded at one end, two pipe flanges, and a nut. One flange is screwed on the threaded end until it is tight, and the other is screwed on until the work is gripped fairly closely, the nut then being used to lock it. With the plate securely gripped in the vise, pressure is applied to the handle as the tool is rolled along the edge of the plate.

To Clean Articles of Steel

An excellent method of cleaning steel articles which have become rusted or oxidized, consists in rubbing the surfaces with pure sweet, or olive oil, applying several coats, then laying them aside for several days, after which they are thoroughly rubbed with unslaked lime.—Ralph W. Jones, St. Louis, Mo.

Knurling with a Threading tool

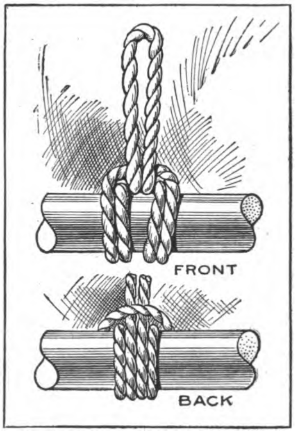
On one occasion my work required some knurling and not having a knurling tool I accomplished the work in the following way: The lathe was geared to cut 20 threads to the inch, and after placing the work in the lathe centers, a cut was taken with a V-threading tool. The gears were then changed to cut a left-hand thread of the same number to the inch, and a thread cut over the first threads in a reverse manner. This gave a knurl equal to a knurling tool, which in some ways was better, as the edges of the cuts were square and clean. The pitch of the thread may be varied to suit the size of knurling desired, but I found that 20 threads to the inch is suitable for most purposes. — Geo. Garrison, E. Orange, New Jersey.

Tool Tray for the Stepladder

Four pieces of quarter-round molding, nailed along the edges on the top step of a stepladder, form an excellent tray for holding tools. The molding is nailed with one flat side down and the other toward the center of the step. Electricians will find this tray of considerable assistance while hanging fixtures, as the tools, solder and tape can be laid on the top without any danger of falling off, even while moving the ladder from one position to another.—W. Norman Fox, Atlantic City, New Jersey.

Safe Sling for Heavy Bars

When handling heavy and slippery round bars with a crane, it is customary to pass the end of the sling around the bar once and then through the loop at the other end. This method is not a safe one, and it occasionally happens that an unbalanced bar slips out of the hitch. The illustration shows the front and rear views of a hitch that is safe, and at the same time self-tightening. The end of the sling is passed twice around the bar, instead of once, before being passed through the loop.—A. J. Denner. Brooklyn, N. Y.



A well-cleaned talcum-powder can makes a good receptacle for flour of emery used about the machine shop.

Shrinking Oversize Bushings

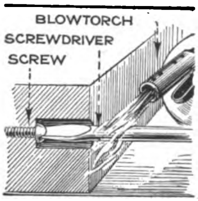
Frequently, in lapping hardened steel bushings, the hole is accidentally lapped too large. It may also happen, after lapping to size, that the hole has not cleaned up, and the bushing must be scrapped. However, by the method of rehardening described, the hole can often be shrunk sufficiently to make a new bushing unnecessary. Turn up a piece of machine steel in the lathe, about .004 or .005 in. under the size of the hole in the bushing. Leave a shoulder on one end of the turned piece, place the bushing over the small end and reharden, quenching the shoulder end first. The water or quenching solution cools the outside of the bushing first and shrinks the hole several thousandths, allowing more stock for relapping.

How to Straighten a Bent Crankshaft

A crankshaft that is not too badly bent may be straightened in the following manner: Heat evenly the part that is bent, and then quickly mount the shaft in the centers of a lathe where it can be turned to determine the high point. This point having been found the shaft should be turned in a position so the high point will be directly down. A stream of cold water is now applied to the underneath, or high part of the bend, which will shrink the part of the shaft at this point quickly and thus bring the shaft to its former shape. Repeating the operation a few times may be necessary. This method has been found excellent for truing up cold-rolled shafting.

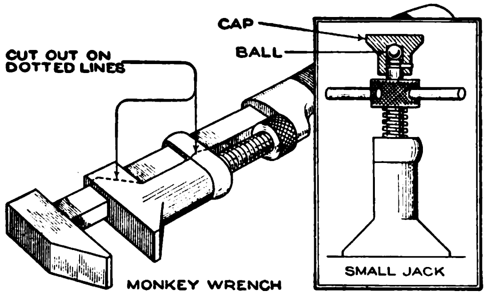
Removing a Counterbored Screw

Having occasion to remove a screw that was set in a counterbore about an inch deep, and that had become "frozen" in and began to break up when the screwdriver was forced, I hit upon the idea of soldering the tip of the screwdriver to the screw and found it successful. By playing the flame of a blowtorch on the screwdriver as illustrated, the screw and the tip of the screwdriver were heated sufficiently to cause a drop of solder to melt and bind both together.—John F. Dwiggins, Petersburg, Tenn.



Jack Made from an Old Monkey Wrench

With a little labor, an old monkey wrench can be converted into a small jack, which can be used in places where it is impossible to employ an ordinary jack, because of its size. The movable jaw of the wrench is cut with a hacksaw, as indicated, to form the base of the device. Two holes are made in the knurled head, and in these are inserted small rods, which serve as levers to turn the screw. The cap is shaped on a lathe, after which a hole is bored in it to receive the end of the screw. A small pin, inserted in the side of the cap, fits in a groove around the screw, and holds the two parts together. A steel ball serves as a bearing. —S. E. Gibbs, Ames. Iowa.



A Handy Small Jack, Which Can Be Used When an Ordinary Jack Is Too Large, Is Made from an Old Monkey Wrench

Rapid and Accurate Repair of Broken Tapeline

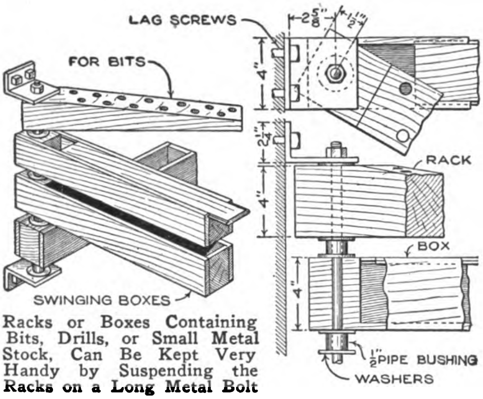
When the only available steel tapeline on a job broke it was necessary to make a repair immediately. A piece, about 1 in. long, was broken out and it was replaced and a good joint made as follows: A piece of steel was cut from an old stovepipe, to the same width as the tape and 3 in. long. It was marked carefully to correspond to the broken part, and riveted into place with ordinary carpet tacks, cut down to the proper length.—P. A. Midland, New York City.

Surface Whiting for Laying Out Work

In laying out work on structural iron or castings, chalking the surface is the usual method, but a better way is to mix whiting and benzine to the consistency of paint and apply the mixture with a brush. The benzine will soon evaporate and leave a fine white surface for the lines.

Swinging Tool Racks or Shelves

Where shop space is at a premium, a great deal can be saved by hanging things on the wall in compact racks. The drawing shows how a large number of bits, screws, or other small parts, can be kept in boxes, or racks, hung on a long vertical bolt, attached to the wall or to a post. A few iron angle pieces will be required—also some washers and ½-in. lengths of pipe to separate the various boxes or racks. Boxes used for this purpose must have a block in one end, through which the bolt passes.



Racks or Boxes Containing Bits, Drills, or Small Metal Stock, Can Be Kept Very Handy by Suspending the Racks on a Long Metal Bolt

An Effective Screwdriver

When a screw cannot be turned with an ordinary screwdriver, the following method is usually successful: Put the cutting edge of a cold chisel in the slot of the screw head and slightly turn the chisel in the direction to loosen the screw. This will cause the chisel to "climb" out of the slot a trifle. Hit the head of the chisel a light, sharp blow which will cause it to bottom in the slot, but the inertia of the chisel in turning to its original position will cause the screw to turn a small amount in the desired direction. By repeating this several times the screw can be loosened so it is easily turned with a screwdriver.—C. A. Gilson, E. Lansing, Michigan.

A Bench Stool on Wheels

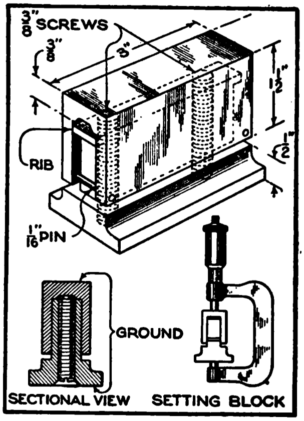
In my regular work, consisting in repairing electric fans, smoothing irons and other small appliances, I find that walking back and forth in front of a 22-ft. bench to get certain tools and materials required for the particular work in hand becomes more tiresome than the work itself. To remedy this, I conceived the idea of putting my stool on small flanged wheels to roll on a hardwood track laid on the floor in front of the bench. It is now an easy matter to reach the test set, at one end of the bench, or the vise, at the other, without leaving my seat. To insure steadiness and permit rapid rolling, the wheel base should be about 3 ft. long.—Chas. K. Theobald, Vicksburg, Miss.

Heating Floor of a Small Shop

The brick floor in my shop is very cold in winter, and to make it more comfortable, I removed the brick and dug a hole, 36 in. long, 18 in. wide and 18 in. deep, in front of the lathe where I stood most of the time. An old two-burner oil stove was procured and set in the hole. I then covered the hole with a board, made to fit tightly, and bored a number of ½-in. holes near the center. A large hole was also cut in at each side for draft. I was surprised at the results of this little heater.—J. H. Priestly, Lawrence, Mass.

Adjustable Parallel Blocks

A very handy and useful parallel block that will save much time, and facilitate setting of work, is made according to the form and dimensions given in the drawing. The vertical adjustment is made by two screws that support the upper member. Such blocks can be used individually, in pairs, or threes, as the job in hand may require, and, by using a micrometer as in the drawing, the blocks are easily set to the same height. The screws should be threaded with a fine S.A.E. thread, which will permit close adjustment. The base of the block is shaped, drilled, and tapped as shown, and notice should be taken of the retaining rib that keeps the two parts of the block from coming apart. The base is wide enough to furnish a good support, and it, as well as the top, is ground to a flat



surface. The upper member slips over the tongue of the base and is countersunk for the points of the adjusting screws. A small pin through each end of the upper member catches against the rib and holds the top and base together.

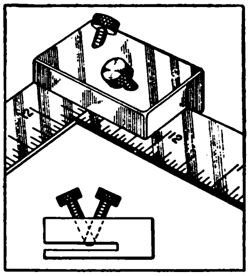
Blocks of different heights, each set overlapping the other in its limits of adjustability, should be made; one set with a 1-in. adjustment, starting with a height of 2 in. and opening out to 3 in., with the next size opening from 3 to 4 in., and so on.

Cooling Air Entering Window Exposed to Sun's Rays

Many shops and factories have windows exposed to the sun's rays and the bricks on that side of the building become heated during the day and in turn heat the entering air, raising the temperature several degrees. A way to cool the bricks is to run along the tops of the windows a water pipe having small perforations made at each window opening. When the water is allowed to run through the pipe slowly, the bricks are moistened and this moisture rapidly evaporates, cooling the air so that it enters the building moist and at a reduced temperature.—Loren Ward, Des Moines, Iowa.

Making a Square from Scales

The drawing shows a convenient little clamp attachment whereby two ordinary machinist's steel scales can be converted into a square, or attached end to end to form a single long scale. The clamp is made from a block of flat steel, slotted to the desired depth to take the scales. The ends of the thumbscrews are turned to a conical point of such an angle that the conical surface is parallel with the face of the scale. It will be seen that with the screws in this position, the action of tightening them rolls the edges of the scales together automatically. Both screws have right-hand threads and knurled heads.

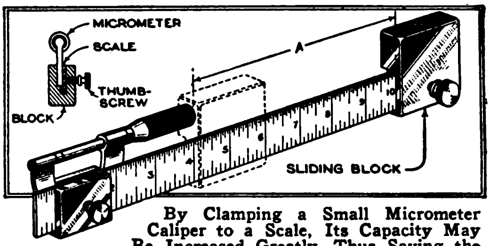


¶It is usually necessary to drill out a broken stud; hence bolts should be used wherever practicable.

Increasing the Range of the Micrometer Caliper

Few mechanics own a micrometer of larger capacity than one or two inches; the larger tools are expensive, and the small range of the smaller ones considerably reduces their usefulness.

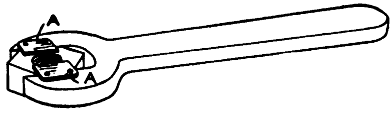
The drawing shows how the range of a 1-in. micrometer may be considerably increased. Make two blocks of cold-rolled steel; one clamps the micrometer to the scale, the other being free to slide, while capable of being fastened at any point. Bring the sliding block to the 4-in. mark, as shown by the dotted lines, and fasten it. Set the caliper at zero, then slide it, held in its own block, against the sliding block, and clamp firmly. The tool is now set. Supposing it is desired to measure dimensions between 5 and 6 in.; the sliding block is moved back until its inner edge is exactly on the 10-in. mark, so that the distance A is 6 in. Any distance between the end of the micrometer barrel and block may now be measured by opening the caliper in the usual way, subtracting the micrometer reading from 6 in. to obtain the desired dimension.



By Clamping a Small Micrometer Caliper to a Scale, Its Capacity May Be Increased Greatly, Thus Saving the Cost of Several Tools of Varying Ranges

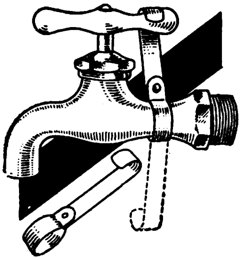
Nut-Holding Clips for a Drop-Forged Wrench

A heavy wrench that required a pull with both hands frequently slipped off the nut or cap whenever I eased up on the pull in using the wrench horizontally. To remedy this I fastened two metal plates, A A, on the jaws. This kept the wrench in position as the plates rested on top of the nut or cap. The plates can be fastened either with screws or rivets.—James M. Kane, Doylestown, Pa.



Each Plate Is Fastened to the Jaw So That the Projecting Part Extends over the Nut

Holding a Self-Closing Faucet Open

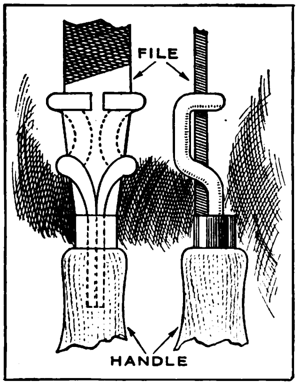


When a large quantity of boiling water is drawn from a self-closing faucet, the handle becomes too hot to be held unless it is covered with a cloth, or kept open in some other manner. A simple way to overcome the difficulty is to use an iron band, bent, at one end, to form a loose loop around the faucet which is held together with a rivet, or bolt and nut. The other end is made to fit the handle when it is in its open position. When not in use, the hook may be swung out of the way, as indicated by its dotted position.—G. Jaques, Chicago, Ill.

Brace Chuck Used as a Small Vise

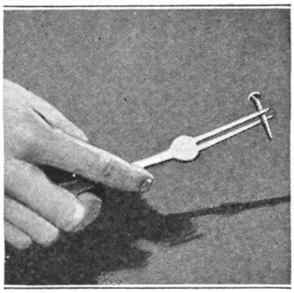
While out on a job I had to cut off a number of screws, and having no vise to hold them, I put them separately into the chuck of a carpenter's brace, which held them securely while they were cut to the desired length with a file.—H. C. Heidt, Chicago, Ill.

Flat-File Attachment



It is not generally known that a handle placed on the front end of a flat file greatly facilitates its use. Anyone who has used a flat, rough file for any length of time knows how awkward it is to keep on filing after the left hand has become sore and blistered from the continual contact with the file's rough surface. A good method of attaching such a handle is to bend a piece of drill rod to the shape shown in the drawing. After bending, grind off half the diameter of the two ends so that when brought together they can be driven tightly into a hole drilled in the wooden handle. The piece is then split at the front to form a spring grip. The front or split part of the attachment should be much narrower than the width of the file, so that when it is pushed on there will be sufficient tension to grip the file tightly. The lines showing the teeth on the end of the file have been omitted from the drawing for the sake of clearness; it is not necessary to grind off the teeth, although it may be found advisable to grind the edges of the file to a more abrupt taper. The size of drill rod to use will depend largely upon the size file with which it is to be used, ¼ to 5/16-in. stock being sufficiently heavy for 8 to 12-in. files.

Old Fork Places Small Screws



Some useful and labor-saving tools can be made from old table forks, the photograph showing such a tool that facilitates replacing of small screws and bolts in positions that would be practically inaccessible by other means. A fork that has seen better days will make just as good a tool as a new one, when it is flattened out and the outside tines ground off, leaving just two at the center, as in the picture.—John H. Schalek, Pittsburgh, Pa.

An Emergency Nut

In doing some repair work I found that I had two bolts and only one nut. The nut happened to be of a good thickness and in order to make a temporary job of it, the nut was split with a hacksaw to make two nuts of one.—Wm. A. Murray, Cold Spring, N. Y.

To Prevent Rust Forming on Tools

Those who desire to use a rust preventive will find that if the tools are wiped with a cloth slightly saturated in mercurial ointment, they will obtain the best results possible. It is not necessary to leave more than a trace of the ointment on the steel. A cloth so impregnated that it will smear a pair of spectacles a little will answer.

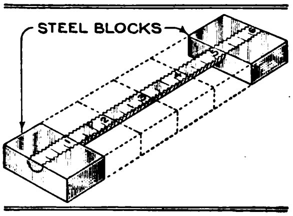
This ointment is the very best possible to use on guns, to prevent them from rusting. It will also prevent the barrels from leading and will remove lead from the rifles. It has no action whatever on the metal of the barrel.

How to Drive Out Bolts

Bolts are very often spoiled in driving them out from the parts in which they are located. If they do not start readily one is often tempted to use the hammer upon them, with the result that the ends of the threads are frequently burred over. A stick of hardwood, or still better, vulcanized fiber, used between the hammer and the bolt end will prevent damage of this kind. When neither is available, the nut may in some cases be run out flush with the end of the bolt, or even a little beyond the end, and a blow carefully placed upon the nut so as not to spoil the threads will probably start the bolt.

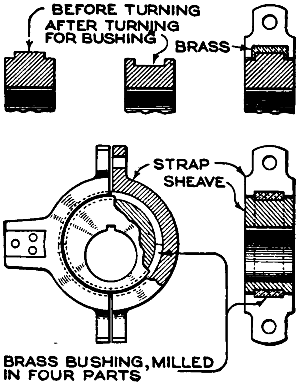
A Novel Scale for Machinists

A new die, having 16 threads per inch, was being tested out on some ¼-in. drill rod, the result being an exceptionally fine-cut thread. A few of these threaded rods were made into 6-in. scales by one of the machinists in the shop in the following manner: Two steel blocks were drilled and tapped for a ¼-16 screw and then cut down at the ends, as shown in the drawing, to about half the diameter of the rod. The threaded rod, resting on the steel half-blocks, was placed on the magnetic chuck of a surface grinder, and faced down flat. After grinding, the rod was removed from the grinder, graduated with a very sharp chisel, and marked with small figures. The half-blocks were moved along, as indicated by the dotted lines, to serve as anvils for the rod during the graduating. The threads, being 16 to the inch, take the place of 1/16-in. graduations, and the chisel marks are ¼ in. apart.—M. E. Duggan, Kenosha, Wis.



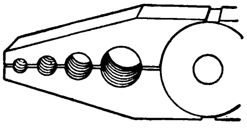
❡A short chalk line, held taut with both hands over a glass or metal surface in which it is impossible to drive a nail or tack, can be snapped very easily by the teeth, if a short length of string is attached to the center of the line.

Repairing Worn Eccentrics


BEFORE TURNING
AFTER TURNING FOR BUSHING
BRASS
STRAP
SHEAVE
BRASS BUSHING, MILLED IN FOUR PARTS

There is a great deal of wear on the circumference of the eccentric sheaves of any engine using the Stephenson valve gear, and a large number of eccentrics are scrapped annually on account of this wear. Railway shops are now using a system that will also appeal to the users of traction and similar reversing-geared engines who find it necessary to re-turn their eccentrics and rebabbitt the straps. Just as soon as the blocks must be re-turned, they should be grooved as in the drawing. A brass shoe or bushing, cut into four sectors, is made to fit the sheaves and strap; as the brass will wear faster than the sheaves or straps, they can be run much longer without re-turning, by renewing the brass bushing when necessary. If the eccentric sheave is so made that it cannot be grooved as shown, it may be reduced in size, still keeping the original shape, and the bushing made to fit both it and the strap, as shown in the upper right-hand detail.—A. A. Stafford, Reno, Nev.

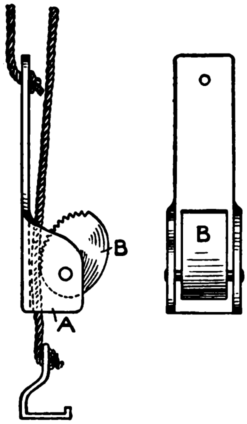
Pliers for Holding Screws



Where it is necessary to handle screws or studs with the ordinary pliers the threads are apt to be damaged. Then, too, it is difficult to hold and handle a round object in flat jaws. A screw-holding plier can be made from the ordinary kind by clamping the jaws together and drilling four or more holes with their centers on the line or joint between the jaws. These holes are then tapped for standard threads. When a screw is taken up in the pliers, the threads are not damaged and the holding power is greater. The surfaces on the jaws should be ground slightly after the holes are finished to make them clamp tightly on the threads of the screw or bolt.—J. J. Kolar, Maywood, Ill.

An Adjustable Stock Holder

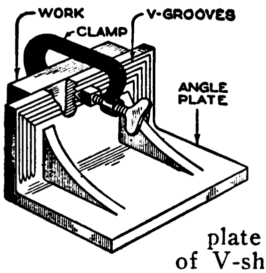
In handling considerable work that required bars of stock to be held horizontally as they were fed into the machines, one of the men devised a holder that was suspended from the ceiling and adjustable for height to suit different classes and sizes of stock.



This holder is shown in the illustration. A piece of flat steel with two wings bent at right angles to the back is formed as shown at A. At its upper end a length of sash cord passes through a hole and is knotted. The free ends run up and through an eye fastened in the ceiling and back down again where it passes between the wings and down to the foot of the holder which is an L-shaped piece in which the stock is laid. To prevent slipping a toothed roller, B, is inserted between the wings. This roller is drilled eccentrically as shown and permits the passage of the cord when it is in one position and holds the cord when in another position. The notches help to hold the cord, and as the weight increases the grip will be greater.

An Improved Angle Plate and Clamp

Angle plates remain pretty much as they have been since the first one was originated, and machinists from that time to the present have been up against the annoyance of having their clamps slip off the flat surface with resulting damage to tools and temper. The drawing shows an angle plate that has a number of V-shaped grooves cast in the back of the plate, parallel with the top and sides; the clamp screw used with this angle plate is provided with a tapering swivel block which fits into the grooves of the plate and prevents shifting. This makes it possible to hold work firmly.—M. E. Duggan, Kenosha, Wis.

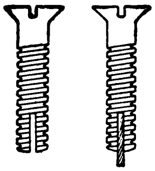


Shop Uses for Old Razor Blades

Old safety-razor blades can be put to good use on the bench by soldering on sheet-metal handles, and then using the blade as a guard in filing the corners of dies and castings. Even a safe-edge file will sometimes cut up a finished metal surface badly, and the blade will form a good protection when any file, even a three-cornered one, is used. Instead of a single handle, especially on repetition work, a metal clip can be soldered to each side of a blade to hold it up against the work, so that both hands will be free to use the file.

To Make Worn Threads of a Bolt Hold

Where it is necessary to use a screw or bolt having worn threads, slot the threaded end and drive a flat wedge into the opening as shown in the sketch. This will make the bolt or screw hold almost as well as if new threads had been cut on it.—Edward Matthews, New York City.



Marking Tools by Electricity

While trying to find some effective way of marking my tools, I tried the following method, which worked satisfactorily. I connected one side of a 110-volt circuit to one terminal of a toaster, joined the other terminal of the toaster to the metal of the tool to be marked, and fastened a piece of lead pencil to one end of a piece of wire and connected it to the other side of the line wire. By lightly tracing my initials on the tool with the lead pencil, an indelible and clearly legible identification mark was made.—Henry Worthmann, Jr., Chicago, Ill.

White Lead Locks Nuts

Many machines, notably agricultural implements, are not fitted with cotter pins to prevent bolts and nuts from loosening. Under continued use, the nut loosens and drops off, or rusts solidly in place, making it difficult to remove. A liberal coating of white lead applied to the threads before screwing on the nuts, prevents each of these conditions. The white lead will harden and lock the nuts, rust is prevented, and the nut can be removed with a wrench. The white lead is also effective as a lock washer when the face of a nut is in contact with wood.

Radial Pivoted Arm for Shop Light

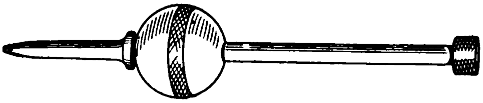
I recently installed a swinging light which reaches nearly all parts of the shop. It was made by supporting a long rod, ⅞ by 3 in. at the thickest portion and tapering toward the ends. The arm was set in two brackets suspended from a circular turntable, pivoted at the middle on a bolt. The latter was fixed through a square plate which was fastened to the ceiling joists with screws. The cord for the electric light was carried on insulators which slide along a wire fixed to the lower edge of the radial arm.—R. E. Brown, Portland, Oregon.

Scribing Lines on Round Work

I have often tried to mark a true line around the circumference of a cylindrical body, such as a shaft, pipe, or piston, but have always experienced trouble in scribing it exactly, until I hit upon the following scheme: Take a piece of paper having a straight edge and wrap it around the cylinder so that the edges line up where they overlap. Then scribe a line along the edge and it will be found perfectly true.—John A. Blaker, West Auburn, Massachusetts.

Prick Punch with Hammer

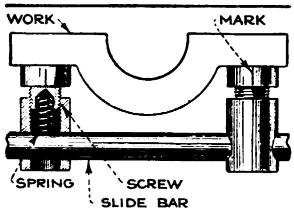
The prick punch made as shown does not require the use of a hammer. The punch is turned from tool steel and a steel ball is drilled centrally to fit on the handle part. The upper end of the handle is threaded to receive a cap to hold the ball in place. The point of the punch is properly hardened. To use, place the point on the spot and raise the ball to the upper end of the handle; then it is brought down quickly to strike the flange at the lower part, which forces the point into the metal.—Abner B. Shaw, No. Dartmouth, Massachusetts.



The Ball on the Handle Is Used for Driving the Point of the Punch into the Metal

Supporting Irregular Work in Machine Vises

Ordinary parallels are not of much use as supports for irregular work held in machine vises, unless the surface of the work touching them is flat. Very often a job can be done more conveniently by using an adjustable support of the type shown in the drawing. This support consists of a length of round rod, forming a slide bar, on which two short lengths of tubing are fitted, the latter being drilled crosswise and threaded inside to receive the work-support screws. The support screws are countersunk, as shown, to receive the ends of small coil springs, which keep the parts together, prevent the screws from turning too easily, and hold the tube pieces in the position set. After assembly, both screws are turned down close to the tube, and while in this position, a mark is cut on each screw head as shown.



Many kinds of work can be supported by machine vises fitted with this adjustable support, the tube pieces being moved in or out to avoid irregularities in the form. The screws are used to suit work of various heights by turning them equally, using the marks as guides. By making the slide bar long enough, work extending beyond the vise jaws can be supported by means of a thin parallel resting on the vise bottom.—Harry Moore, Montreal, Can.

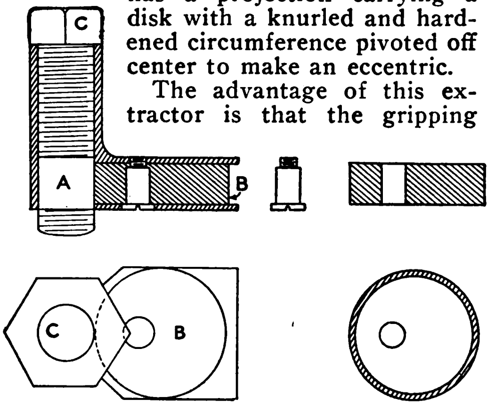
Holding Tools in Their Handles

A good adhesive for holding tools in their handles is resin and a small quantity of rottenstone. The hole in the handle is filled with the powdered resin to which has been added a little rottenstone. The tang of the tool is heated and pushed into place. When cold, it will stick firmly in the handle.

Cleaning Files

A good method of cleaning files that have been used on wood or soft metal such as lead, is to rub the end of a brass or copper strip over the file in line with the grooves. This cuts notches into the brass corresponding to the grooves on the file and will clean the file of foreign substances more effectively and quickly than a steel brush or any other method. A thin piece of stock, about ¼ or ½ in. in width, will do the work best.—H. Olsen, Park Ridge, Illinois.

A Stud Extractor



The Gripping Part of the Extractor Takes Hold on the Stud Where It Has No Threads

The extractor consists of a sleeve with a hexagon head, the bottom part of which has a projection carrying a disk with a knurled and hardened circumference pivoted off center to make an eccentric.

The advantage of this extractor is that the gripping part comes in contact with that portion of the stud A having no threads, which is in the center or close to the joint. The threaded portion of the stud is protected inside of the extractor. The grip of the eccentric disk B will be tighter as the pull is applied to the hexagon part C, and is easily released by a slight backward turn.—Richard Flagen, Cardiff, England.

Substitute for a Hanger Bolt

Hanger bolts which have a wood screw on one end and a machine screw on the other are not always carried in stock by hardware dealers. When they cannot be obtained a substitute may be made by sawing off the head of a wood screw and cutting machine threads on this end.

How to Remove Broken Cap Screws

Grind the twist drill so the cutting edge will be on the back side and to cut when the drill is turned backward. Drilling in this way will often remove the broken screw long before the drill will cut its way through. This saves the necessity of chipping out the shell that is left when drilling in the ordinary way.

Melting Sulphur

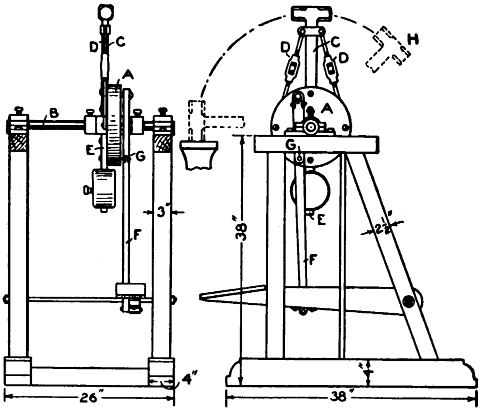
Sulphur is often used to anchor bolts in cement or stone floors, but as it catches fire so easily when melted over an open flame, its use is somewhat inconvenient. This difficulty can, however, be avoided by first melting some lead, and then partly immersing the sulphur vessel in the molten lead. The sulphur will be melted in a short time, and there it will not catch fire, unless the temperature of the lead is allowed to exceed 625° Fahrenheit.

Making a Screwdriver Magnetic

Magnetized screwdrivers are useful for many classes of work, the carbon steel of which screwdrivers are made being capable of retaining considerable magnetism. A screwdriver which will retain a considerably stronger magnetism than an ordinary one, may be made from a round piece of tool steel, or preferably of tungsten steel, by simply grinding the end of a bar into the form of a very short screwdriver blade.—Maurice Clement, Youngstown, Ohio.

A Foot-Power Hammer

A cheap and efficient foot-power hammer or striker may be constructed as shown and will prove a valuable addition to the ordinary shop equipment for welding or heavy hammering. Sufficient dimensions are given to enable the owner of a small shop to construct one suitable for his needs by making the necessary changes.



An Inexpensive Foot-Power Hammer That Can Be Made for the Small Shop

The main working parts consist of a cast-iron wheel, A, 12 in. in diameter, with a long hub, which turns on the stationary axle B, between two collars, and carries the hammer and counterweight, together with the crankpin and connecting rod to the foot treadle. These parts are supported on a frame made of hardwood as shown.

The bar C, carrying the hammer, is

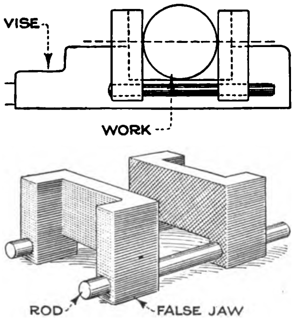
solidly bolted to the wheel A and is braced with two rods, DD, having turnbuckles. The bar is made of steel, ⅝ in. thick, 1½ in. wide and about 16 in. long. The bar E, carrying the counterweight, is securely bolted to the opposite radius of the wheel. The weight attached to the end of this bar should be about twice the weight of the hammer, and fitted so that it can be adjusted to the proper distance from the center of the wheel to bring the hammer quickly back to the position shown.

The connecting rod F is jointed at G to allow the crankpin to pass over the center and the hammer to recede toward the position shown by the dotted lines at H for a longer stroke, the upper end of the connecting rod forming a rocker arm to bring the crankpin back.

¶To prevent a round-head bolt from turning in wood or metal, drive a prick punch, close to the edge, through the head and hold the punch while turning the nut.

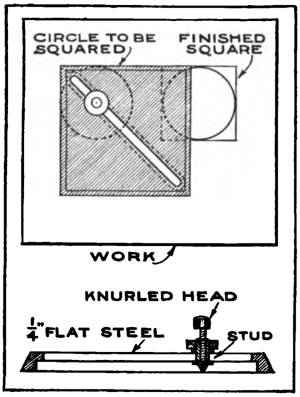
Removable Jaws for Machine Vises

The narrow depth of milling-machine vises requires the use of some kind of false jaws when it is necessary to hold work with a bearing point above the fixed jaws; a shaft of such a diameter that the center is higher than the top of the vise jaws is a familiar example. Removing the regular jaws and attaching false jaws by means of screws and dowels, may take more time than the job warrants, but the removable jaws illustrated can be slipped into place or out again in a second or two. Two pieces of flat stock are shaped as illustrated, to fit the vise, and cut away in the center to allow the sides to hang down against the sides of the vise. Two tool-steel rods are then driven tightly into holes drilled in one of the jaws, the holes in the other jaw being large enough to allow it to slide on the rod guides. The jaws provide a good bearing for the guide rods and are held in line by them when the vise is tightened on the work.



Gauge for Laying Out Square Holes

To inclose a circle accurately in a square requires considerable time and care, and when a number of squares are to be laid out, the job becomes very tedious. The tool shown in the drawing, if accurately made, will greatly simplify the squaring of circles of any diameter within its capacity. The body is made from ¼-in. flat steel, ground square and beveled on the edges. A slot is cut diagonally through the piece and then milled out to a slightly greater width for about two-thirds of the thickness of the stock. A center, made of tool steel, has a knurled head pinned or riveted to it after final assembly, as indicated by the drawing. To enable this center to slide up and down in the slot, a stud is made with a head of the same diameter as the greatest width of the slot, with a shank which is a sliding fit in the smallest width. A knurled nut, fitting the threaded stud, completes the tool.



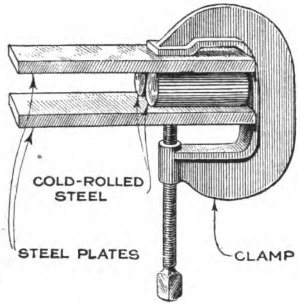
To square a circle, push down the center and place it in a punch mark made in the exact center of the circle, the nut on the stud being loose; let the body of the tool rest flat on the work and slide it gently until the two edges coincide exactly with the scribed circumference of the circle; then tighten the nut. After lines have been scribed along the two sides, turn the tool around on its center and repeat the operation to form the other two sides of the square.

Scriber Set in Fountain Pen

The mechanic frequently finds it necessary to carry a scriber around, so that it is available whenever needed, but to carry it in one's pocket is rather dangerous. To overcome this difficulty, a scriber point can be set securely in the barrel of a fountain pen in the same position that the pen point and feeder otherwise occupy. The cap is screwed on the barrel as usual.

An Emergency Snap Gauge

A serviceable snap gauge for use in emergency may be formed as illustrated. A piece of flat steel is clamped on each side of two short sections of round cold-rolled steel. The round pieces should, of course, be selected carefully, as near the required size as possible, and all burrs should be removed before assembling. For work where great precision is not essential, a gauge of this kind will be better than calipers.



Measuring Diameter without Calipers

To measure the outside diameter of a pipe, shaft, or like object, when no calipers are available, tie two nuts or screws to the ends of a length of string and throw one end over the object. When the ends stop swinging, measure the distance between the cords. The measurement thus obtained is sufficiently close for ordinary work.

Making Holes in Glass

Around the shop it is often necessary to make holes in glass; this is more or less difficult with a drill, but there is a simpler method that nearly always gives satisfaction. A putty or clay dam with an opening in the center the size of the hole desired, is made on the glass; then the opening is filled with melted lead and if the glass is not too thick the piece will immediately drop out.

Trousers Guards an Aid to Drawing On Overalls

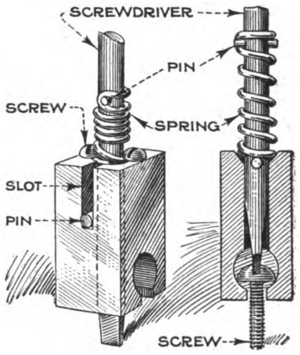
When a person's work demands the use of overalls, I find it very handy to keep a pair of bicycle trousers guards in the pockets, and have them ready to place on the regular trousers before the overalls are drawn on. This will keep the legs of the former from being drawn halfway to the knees, as is often the case. After the overalls are on, the guards can be removed and placed in the pocket.—R. B. Strong, Homer, Mich.

Handy Wrench with Drift-Pin Handle

When erecting or installing machinery where cast-iron flanges, with bolts, connect the parts, it is often necessary to draw one of the flanges into place, to get the bolt holes to match. When there is not sufficient clearance to use a mandrel or drift pin, a rod bent to a short right angle is handy. An angle of this kind forged on the handle of a wrench, combines two useful tools, and has proved quite popular, as indicated by frequent borrowing of it.

Placing Screws in Deep Slots

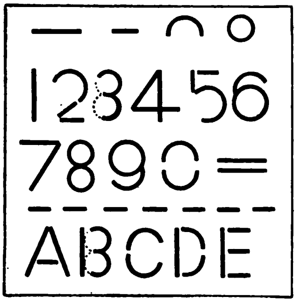
In the final assembly of a machine used in the printing trade, it was necessary to screw a number of round-head screws into the bottom of slots where the hand could not reach. To do the job, the special screwdriver illustrated was used. A loose sleeve, of square stock, was drilled lengthwise to fit the shank of the screwdriver. At right angles to this hole, near the bottom of the sleeve, a hole large enough to fit the heads of the screws was drilled, and a slot, breaking into the hole, cut across the bottom of the sleeve. A slot is also milled halfway down the sleeve, running into the lengthwise hole, as indicated. A pin, driven into the shank, fits in this slot, and keeps the blade of the screwdriver in line with the slot in the bottom of the sleeve. A slight countersink is cut in the lengthwise hole, at the top, to accommodate the bottom coil of the tension spring shown; this coil is held down in the countersink by two small round-head screws, and the other end of the spring is looped around a pin driven through the shank.



Normally, the blade of the screwdriver projects as shown at the left; when it is necessary to place a screw in a slot, the sleeve is pulled down and a screw slipped into it, as at the right, the tension of the spring holding it tightly. When the screw has been started in its hole, a slight side pressure slips the sleeve off, and the screw is then driven home as with any ordinary screwdriver.

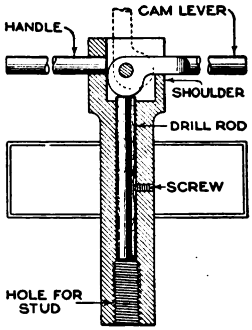
Improvised Letter and Figure Dies

Some time back I needed a set of letter and figure-stamping dies, and found that commercial ones were not obtainable without considerable delay. In the emergency I made up four dies that will make any letter or figure. The characters made by the individual dies consisted of a long and a short straight line, a small circle, and a crescent slightly less than a half circle. By combining the marks made by the separate punches, it is possible to form the letters and figures as shown.—W. F. Boast, Casper, Wyo.



A Hand Stud Driver

Wherever a number of studs of the same size are to be driven, the hand-operated driver shown in the drawing will be well worth making.

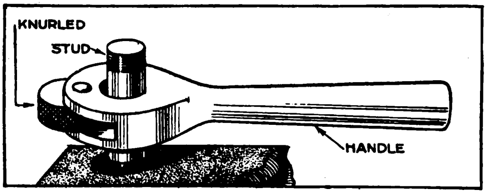


The body is drilled entirely through, and is tapped for a short distance at the bottom to take the studs to be driven. A piece of drill rod, cut to the required length, is provided with a small flat so that it can be held loosely inside the body by a small setscrew, as indicated. The top of the body is slotted to take the cam lever, leaving a shoulder for the lever to rest upon when the stud is being driven. The cam lever is made as shown, and is held in place with a pin, upon which it turns, while a fixed handle is set into the opposite side of the body.

In use, the driver is threaded onto a stud until it touches the end of the internal rod, the cam lever being horizontal. The stud is then driven home in the work. To release the driver and permit it to be backed off the stud, the cam lever is raised to the position indicated by the dotted lines, which relieves the pressure against the stud.

Eccentric Wrench for Stud Removal

The wrench illustrated will remove studs of various diameters in the minimum of time. It is simple to construct, consisting mainly of a steel circular-ended handle. This is drilled to accommodate the largest size of stud which it is desired to remove. A hole is also drilled for the insertion of a pivot pin, for an eccentric clamp.



A Reversible Wrench, Which Grips by Means of an Eccentric, Is Effective in Handling Studs

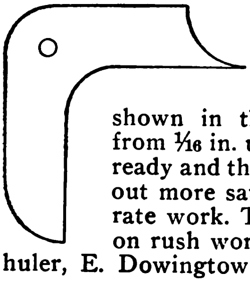
The clamp roller is of steel, knurled and hardened, and is fitted to revolve freely in a sawed slot. The eccentric clamp permits either the insertion or removal of the studs, as is desired. In work on gas and steam-engine cylinder heads, a wrench of this type saves considerable time; also for turning pipe and rods, this tool can be used to advantage.

Clip for Pocket Scale

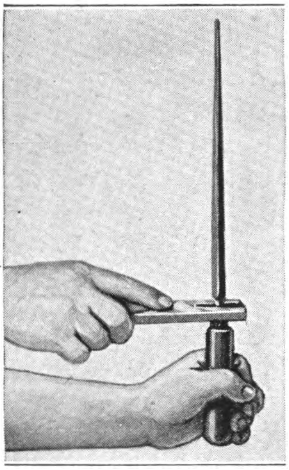
The annoyance of having a scale slip from the pocket is experienced by most mechanics, and in order to overcome this nuisance, I made a clip of sheet brass, 1/32 in. thick. It was clamped securely to the end of the scale and prevented the latter from falling out of the pocket. Others in the shop thought so well of it that in a short time many had made clips similar to mine.—John I. Blaker, Worcester, Mass.

Radius Templates for Mechanics

Usually a drawing calls for a radius on shafts and the workman must make a radius template of paper. A better way is to provide a set of templates like the one shown in the sketch, in sizes from 1/16 in. up. They are always ready and the workman will turn out more satisfactory and accurate work. These will save time on rush work.—John A. Kagerhuler, E. Dowingtown, Pa.

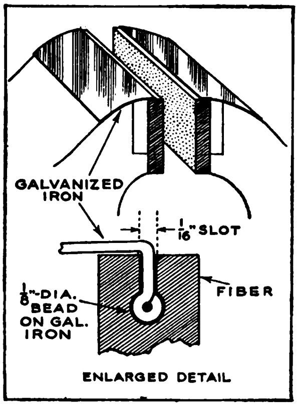


Tool for Removing Handles from Files



In shops where a box of files is carried around from one job to another, each one is not fitted with a handle, because of the space that this would require. Two or three handles are used, and these are usually knocked off and then fitted to other files, as required. Using the files themselves to do this, as is commonly done, is very injurious to the teeth, as both faces are scraped together, and furthermore, the files are frequently broken in this way. The photograph shows a simple tool for removing the handles. It is made of flat stock with a tapered slot cut in one end. By holding this tool in one hand, to grip the file, as shown, it is an easy matter to pull the handle off with the other hand.

Improved Fiber Vise Jaws

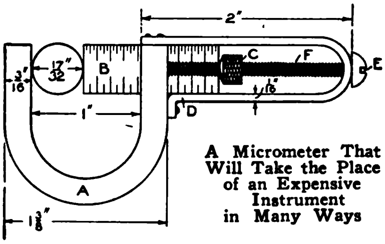


One of the necessary attachments for the vise in the machine shop is a pair of soft vise jaws. Fiber is rather better than brass for this purpose, as it will not scratch metals softer than brass. Many different designs of fiber jaws have been used, sheet-metal shrouds riveted to the fiber being perhaps the commonest. One objection to this form, however, is that when the fiber wears, the rivet heads are exposed, bruising the work. If the jaws are made as shown in the drawing, this cannot happen. A bead is formed on the sheet metal, fitting into the slot shown, the bottom of which is formed by a circular-ended tool, in the shaper. The jaws are made of 5/16-in. vulcanized fiber. Where the jaws are narrow enough, a hole can be drilled for the bead, completing the slot with the hacksaw or milling cutter.

A Flexible Socket Wrench

For use in places where an ordinary wrench cannot be applied, a flexible socket wrench is useful. It is a homemade device, the socket portion being formed from a short piece of iron pipe and the other sections from steel pipe. It may be made in various sizes and provided with several sizes and shapes of sockets, which can be fixed into place as desired, by means of the pin.—Charles C. Brabant, Detroit, Michigan.

Homemade Micrometer

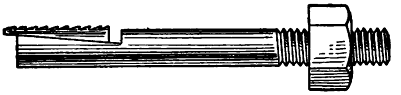


A Micrometer That Will Take the Place of an Expensive Instrument in Many Ways

Desiring to have something a little different in the way of tools from other mechanics, I constructed a very useful measuring device that takes the place of a micrometer. The jaw A is made of 3/16-in. square, cold-rolled steel, heated and bent as shown. This is slotted on one side to admit a piece of scale, B, 1 3/16 in. long. Before slotting the jaw a hole is drilled centrally in the location of the slot and tapped for a 10-32 machine screw, F. A 1/8-in. hole is drilled through the entire length of the screw in the center and is also slotted 1 3/16 in. to receive the scale. The head end of the screw is supported by a yoke, D, made of 1/16-in. steel, 3/16 in. wide and fastened with rivets to the jaw A. The knurled nut C is used for adjustment. A small closed spring made of .013 spring wire, wound on a rod measuring .085 in. in diameter, is inserted in the 1/8-in. hole in the screw and fastened at one end to the scale and at the other with a pin, E, in the slot of the screw head. This provides a tension on the scale to keep it against the knurled nut C. The measurement is read on the scale between the outside surface of the jaw A and the nut C. There is satisfaction in making such a device.—J. J. Kolar, Maywood, Ill.

An Expansion Bolt

Procure an ordinary bolt of the proper length and size and saw a wedge-shaped notch, about 1¼ in. long, in the end, as shown in the sketch. The piece sawn from the bolt is serrated on its outside surface and placed in the notch. The piece and bolt are inserted in the hole and when the nut is turned up, the piece will wedge the end and hold it solidly in place.—G. H. Holter, Jasper, Minn.

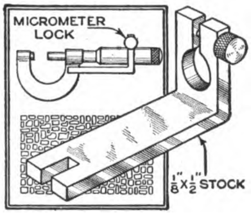


As the Nut Is Turned Up the Wedge-Shaped Piece Tightens the Bolt in the Hole

Micrometer Lock for Repetition Work

When gauging repetition work, or finishing work that requires constant testing with a micrometer, it is necessary to have some means of locking the sleeve of the instrument, else the setting must be examined and perhaps adjusted every time it is picked up. Large numbers of micrometers are not provided with locknuts, and the simple device shown in the drawing is designed for use in such cases.

An L-shaped piece of cold-rolled steel stock, ⅛ by ½ in., is slotted at one end to fit the frame of the micrometer very closely, and bored at the opposite end to make a neat fit for the sleeve. A slot is sawed through the hole, and a hole drilled and tapped to take a 1/16-in. knurled-head screw. The lock is placed on the micrometer as shown in the drawing, and tightened in position when the sleeve is adjusted to the proper measurement. On some micrometers the knurl on the sleeve extends down almost to the graduations; in this case, of course, the hole in the clamp is bored to fit the outer diameter of the knurls.

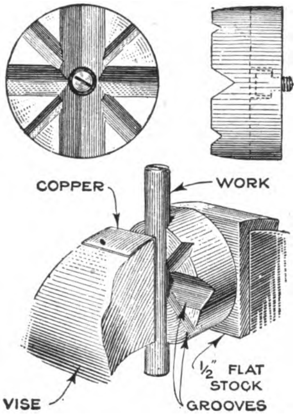


¶An emergency brush for many purposes can be made by bending a pipe cleaner and using the point at the bend for the purpose desired.

¶Provide a special file for filing babbitt, and oil it slightly to prevent the metal from sticking.

Holding Round Stock in Vise

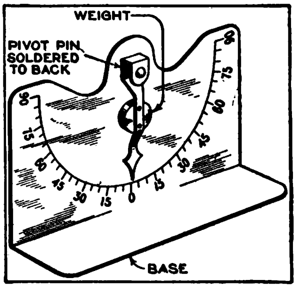
A handy fixture for the shop holds round stock in the vise at any angle, so that the work cannot slip. The body of the device is made from a 3-in. disk of cold-rolled steel. This disk is drilled and counterbored in the center for a fillister-head screw, and V-grooves are cut across the face, starting with a deep groove and finishing with a shallow one suitable for holding very small pieces of drill rod and similar work. To complete the attachment, a piece of ½-in. flat stock is bent to the shape of the vise jaw, and drilled and tapped to take the screw that holds the revolving disk. The opposite jaw of the vise can be covered with an ordinary copper clamp, if it is desired to avoid marring the work. This device is quickly put into place.



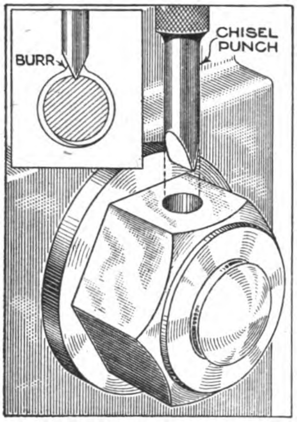
A Simple Inclinometer

A level, reading in degrees, will be found a useful addition to any mechanic's tool equipment.

The main part of the instrument, which comprises the frame, base, and scale, is made of thin, bright sheet metal, preferably brass, bent to shape, as indicated. The graduations are laid out with dividers, on an arc, and numbered with ⅛-in. figure stamps. The pointer is also made of sheet metal and has a round brass weight riveted to it. The pivot holes at the center of the arc, and through the pointer, are made with a No. 45 drill; the pivot pin should be provided with a head on one end, the other being soldered at the rear of the frame.



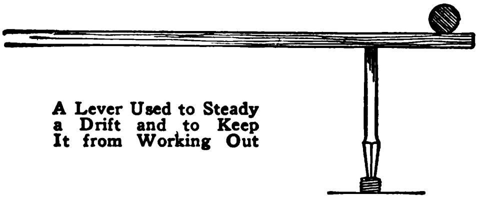
A Simple Locknut



The drawing shows one of the simplest forms of locknut, that will stay in place without loosening until forcibly removed with a wrench. A 3/16-in. or larger hole, the size varying with the size of the nut used, is drilled through the side of the nut. After the nut has been tightened, a nick is cut across the bolt thread, using a small chisel punch as shown. The hole serves a double purpose, as it permits insertion of the punch and forms a cavity for the upraised burr, which prevents the nut from turning. Naturally, to be the most effective, the cutting edge of the chisel should be held parallel to the axis of the bolt when raising the burrs.

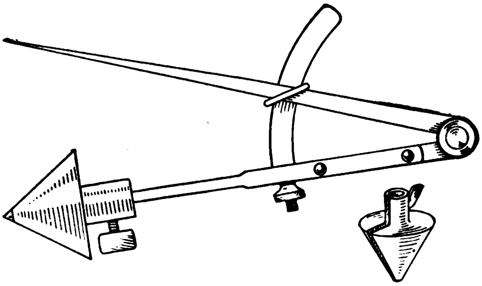
Removing Stub End of a Broken Screw

Very often a screw is broken off in a piece of machinery. A common method of removing it is to drill a hole about ⅛ in. smaller than the root diameter of the screw in the end, then drive in a square drift and twist it until the broken part comes out, using a wrench for greater leverage. This method is a good one and quickly accomplished, but it has one objection: the drift used must be tapered to start it and fill the hole as it is driven. The taper is the cause of the trouble, as it makes the drift easily loosened in the hole, and once loosened, it will slip up a little and cut the hole instead of starting the screw. A straight drift cannot be used for the reasons mentioned. The way to make the tapered one effective is to keep it in the hole and to avoid wriggling at the top, which loosens the drift. To keep the drift in the hole is simple enough by using a bar, a piece of board or a lever of any kind on top of the drift, and in almost every case the broken screw will come out. The sketch shows a piece of board fulcrumed on a shaft or any support and acting to keep the drift in place while it is turned.


A Lever Used to Steady a Drift and to Keep It from Working Out

Cone End on a Compass Point

It is sometimes necessary to scribe a large circle concentric with a hole that has been drilled in a piece of metal. This is very difficult to do accurately with the ordinary compass, but if the compass is slightly improved, as shown, the circle can be drawn perfectly true. Cut off one of the legs on a pair of compasses and substitute a straight ¼-in. rod, which is riveted to the compass shank as shown. Turn up a brass or steel cone to fit on the rod and provide a small thumbscrew to adjust its location. A slot is cut in the cone to allow the shank of the other leg to be drawn close to the cone's center when small circles are to be drawn. The cone adjusts itself to holes of various sizes, up to those almost as large as its base.—H. W. Hahn, Chicago, Ill.


The Cone Adjusts Itself in a Large Hole and Provides a Center for Scribing Circles

Old Files Made Serviceable by Treating with Acid

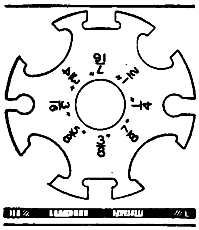
Files that have been worn until they are no longer fit for use may be made to render additional service by soaking them for 48 hours in a weak solution of sulphuric acid. The worn teeth are corroded so that numerous sharp cutting edges remain. When using sulphuric acid it should be remembered that it is poisonous and corrosive, and should be handled with great care.

¶To split off a tight machine nut with a cold chisel is sometimes more economical than to risk ruining the bolt threads.

Removing a Stubborn Nut

Heat an open-end wrench that fits the nut and while hot place it on the nut and allow it to remain for two or three minutes. The heat will cause the nut to expand and it can be taken off with ease. A heated wrench gives much better results than a blowtorch, as the torch will heat the nut and bolt at the same time, where the hot wrench only heats the nut. Any nut which resists the hot wrench will probably have to be split to take it off.

Handy Gauge for Machinists

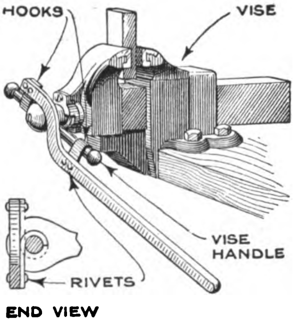


A great deal of time is wasted by machinists in using calipers and micrometers to measure small work approximately. A gauge made similar to the common wire gauge, as shown in the drawing, has been found to be a valuable tool, as with it measurements can be made in a fraction of the time otherwise consumed.

ℭA knob formed of friction tape on the end of straight tool handles will aid in guiding the tool as well as prevent its slipping from the hand.

Extra Leverage on a Vise

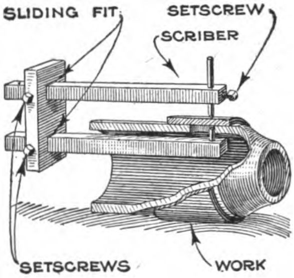
A casual examination of the average vise handle shows that it has been roundly abused by the hammer of the user whenever it was necessary to tighten up the jaws beyond his strength. Some mechanics use a piece of pipe over the handle, but this slips, and is not so universally satisfactory as the device shown.



A ⅜ by 1-in. machine-steel bar is forged to the shape shown, and provided with two hooks, riveted to it so that their curved ends are on opposite sides. The bar should not be more than 2 ft. long. In use, the hooks are slipped over the vise handle and pressure applied. When the vise is to be opened, the lever is applied to the underside of the handle.—W. B. Bennett, Honesdale, Pa.

Scriber for Marking Patches

For locating and scribing setscrew holes, oil holes, or slots at any point, on a patch or ring that has been shrunk over the hole or slot, the scriber shown will save considerable time. As an examination of the drawing will show, the device is extremely simple, consisting of only a square steel block and two movable arms, the latter sliding through holes in the block, and locked, when adjusted, by means of setscrews. The lower arm is fitted with a locating pin driven tightly into a hole drilled near the outer end of the arm, while the upper arm has a scribing point fitted near its end, a setscrew making the scriber adjustable for different thicknesses.



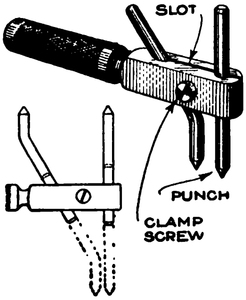
When a hole is to be located, it is only necessary to insert the arms into the work, until the locating point on the lower arm enters the opening; the scribing point is then adjusted and the device manipulated until the location of the hole has been scribed on the surface of the ring or patch.—Leon Yacobyan, New York City.

Spring Holds Apron

Considerable time is lost when one is in a hurry, in tying or untying the ordinary workshop apron, which is fastened about the waist with tapes. However, if the tape is removed and a piece of stiff clock spring, bent to conform to the waist, is inserted instead, all further troubles with the strings are removed. The spring is easily taken out when the article is to be laundered.—Forrest Benson, Boulder, Colorado

ℭWhen babbitt metal is heated, some of the tin and antimony in it is burned out, making it unsuited for use in machinery bearings after several heatings. The oxidation of the metal is indicated by the formation of a scum.

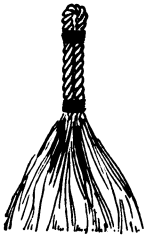
An Adjustable Spacing Punch



The drawing shows a holder made of a length of square or rectangular cold-rolled steel, in which two punches are inserted. It is used for laying out work where a series of equally spaced points are to be prick-punched at any desired · distance apart. The holder has a knurled handle turned at one end, while the square part is drilled for the punches, the inner hole making about a 30° angle with the outer. The end is slotted, and a clamp screw is fitted to hold the punches in place, when set so that their points are the proper distance apart.

One punch, which serves as a guide, has its pointed end bent as shown; the other is straight, and a hammer is applied to the top in the same manner as on an ordinary prick or center punch. A mark is made, the holder is moved along until the bent point registers in the mark; then another mark is made, and so on, until the work is completed. By pushing both punches down, their points will come nearer together, or by reversing them, as shown in the lower drawing, they can be set at a greater distance apart.

Duster Made of Hemp Rope



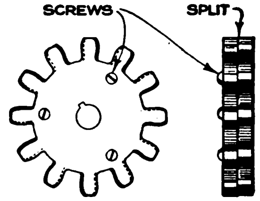
Procure a piece of 1-in. hemp rope about 18 in. long and bend it in the center, then bind about 5 in. of the two parts together with a strong cord to make a handle. The remaining unbound part is loosened and combed out to form a brush. This makes a good duster for a shop bench. —Samuel D. Laurie, Hannibal, N. Y.

Relieving Jar of Hammer Handle

When using a small hammer on quite heavy work, it often happens that the handle vibrates and causes a very unpleasant feeling in the hand. To remedy this, bore a ⅜-in. hole, about 2 in. deep, in the large end of the handle and fill it tightly with beeswax. Long handles in large sledges can be treated in the same manner, but the hole should be larger and deeper and completely filled with the wax. —E. C. Stevens, Detroit, Mich.

Taking Up Backlash in a Gear

After considerable use, the teeth of some gears wear away, and allow a certain amount of backlash when the gears are running under a heavy load. Where a new gear is not easily procurable, this excess play can be eliminated by the following method:

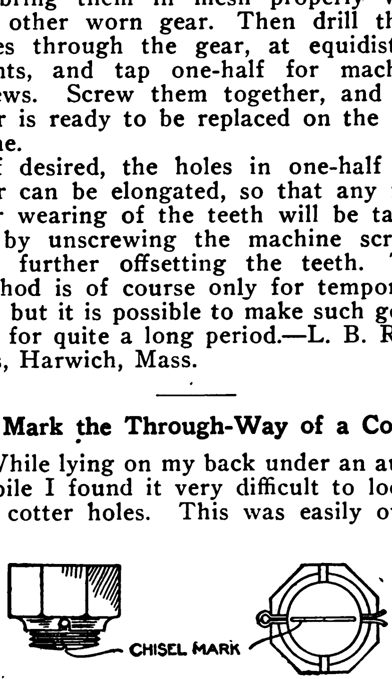


Remove the gear and split it in half with a machine saw. This must be done carefully, to insure that the parts be of even size and thickness. File away all roughness, and grind off the faces cut by the saw. Then place the halves together again and clamp firmly, offsetting the teeth just enough to bring them in mesh properly with the other worn gear. Then drill three holes through the gear, at equidistant points, and tap one-half for machine screws. Screw them together, and the gear is ready to be replaced on the machine.

If desired, the holes in one-half the gear can be elongated, so that any further wearing of the teeth will be taken up by unscrewing the machine screws and further offsetting the teeth. The method is of course only for temporary use, but it is possible to make such gears run for quite a long period.—L. B. Robbins, Harwich, Mass.

To Mark the Through-Way of a Cotter

While lying on my back under an automobile I found it very difficult to locate the cotter holes. This was easily overcome by cutting a small mark with a chisel edge across the bolt end in the same direction as the hole in the bolt. A hole thus marked can be easily located.—Chester L. Cobb, Portland, Me.



The Chisel Cut on the End of the Bolt Shows the Direction of the Hole

Tin Chloride Removes Rust

A rusty metal rule may be made silvery white in color by allowing it to remain overnight in a saturated solution of tin chloride in water. Rinse the tin solution off the rule by holding it in running water. Dry with a chamois, and keep it in this improved condition by the use of oil. The solution may be kept for future use.—W. S. Standiford, Youngstown, Ohio.

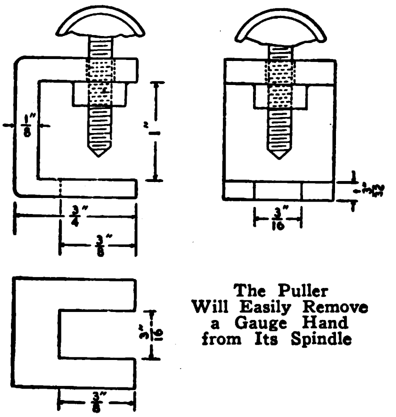
Keeping Dampness from Tools

In most climates where excessive dampness prevails, the manner in which rust attacks edged tools is very aggravating. It will be found that a small open box of unslaked lime, kept in a corner of the tool box or cabinet and replenished from time to time, will absorb the excessive moisture and keep the tools in good condition.—Bert L. Forse, Poughkeepsie, New York.

A Gauge-Hand Puller

Gauge-hand pullers are tools easily lost and somewhat expensive at best. The sketch illustrates one that can be readily made very cheaply from a stove bolt and a small piece of sheet steel. The nut of the stove bolt is soldered to the inside of the U-strip, and its head is flattened out to form a small thumbscrew head.

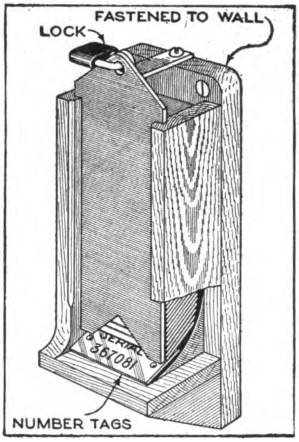
Stove bolts are cheap and standard in size, and it is consequently possible to have a number of stem points ground for different-size hand stems. For the mechanic on this class of work who must supply his own tools, this homemade device is a money saver, and it is so simple that most any one can make it in a few minutes.



The Puller Will Easily Remove a Gauge Hand from Its Spindle

Case Holds Tags Numerically

An adaptation of the device shown in the drawing can be used to deliver consecutively numbered tags or plates, such as used for marking machinery, automobiles, and the like, and is suitable for the accommodation of plates that are made up and stored in advance of the parts being made.



The holder is made from hardwood with a compartment the exact size of the plates, the lower end of the slot being curved, as shown, so that the plates will move forward and downward as the bottom one is removed. A sliding front that fits into grooves in the sides is removable for replenishing the supply of plates; to prevent tampering with the contents, the holder can be locked.—G. A. Luers, Washington, D. C.

Iron Pipe as Gear Puller

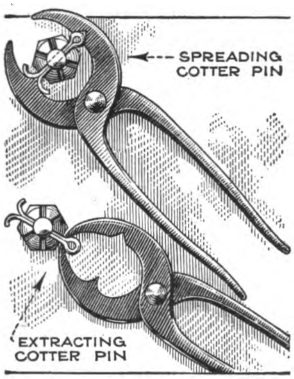
One way to get a gear off a shaft is to find a piece of pipe a little larger than the shaft, file off the end to a very nearly true surface, and clamp it to the bench. Then slam in the shaft and let the gear strike the end of the pipe. If the gear is hard, it will not be damaged by the blow against the pipe, and if the pipe is faced off pretty accurately there will be little, if any, tendency to damage the shaft. This plan will work with a short shaft.

Filing Small Screws

Filing the ends of small screws is usually rather awkward, on account of the difficulty of holding them firmly. This difficulty can be overcome by placing the screw in a pair of pliers, or nippers, and screwing the latter up tightly in a vise. Care should be taken to place the pliers, or nippers, in the vise as close to the fulcrum as possible to prevent possibility of cutting the screw.—F. R. M. Dunseith, Scranton, Pa.

Tool for Spreading and Extracting Cotter Pins

In garages, where it is necessary to extract and spread cotter pins frequently, the special tool for this purpose shown in the drawing will be found of considerable utility. An old pair of pliers is forged and filed to the shape shown in the illustration, then hardened and tempered. A lip on one jaw opens the cotter pin and spreads it, while the notch in the other jaw prevents the head of the pin from slipping. The ends of the jaws are ground down to fit under the head of the cotter pin to extract it, as shown in the lower drawing. The jaw ends should be rounded, to prevent cutting the pin.



Sizing Mandrels

It often happens that a mandrel may be necessary for a certain repair job, when there is none at hand to fit the work. The old method of enlarging a mandrel, when found a little too small, was to cover its surface with center-punch marks. I find, however, that the two methods now to be described are far superior to the use of center-punch marks.

In the one shown in Fig. 1 a common knurling tool is used on that part of the mandrel where the close fit is required. The second, Fig. 2, is to roll a series of grooves or corrugations with the corner of a roll, such as is used to finish axle journals. In either method, the enlarging of the mandrel is supposed to be accomplished without any tempered or case-hardened surface, so that the metal will be shaped by the rolling process.

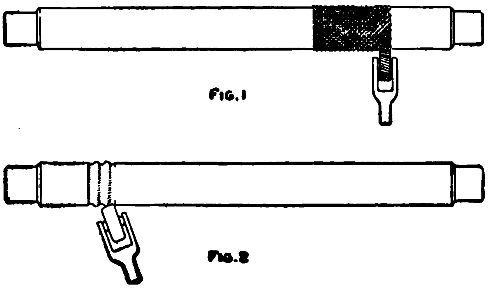


Fig. 1

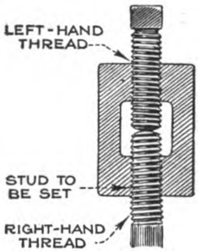
Fig. 2

Mandrels May Be Enlarged a Trifle by Knurling or Rolling Corrugations on Their Surfaces

The knurling method has been successfully used to enlarge bushings that were turned too small.—J. H. Maysilles, Rochelle, Ill.

Improved Stud Tool

The two most common methods of setting studs are to use a stud tool that has a continuous thread through it, of the same size and hand as the stud, and to use locked nuts. Both of these methods require the use of two wrenches in releasing the tool from the stud, one wrench holding the tool or lower nut, while the other is used to loosen the upper nut or setscrew. An improved stud tool, that saves much time, is made as shown in the illustration. It is recessed in the center; one end is threaded to fit the stud, and a thread of the opposite hand is tapped in the other end, in which a setscrew is fitted. Simply turning the tool down on the stud, with the setscrew in place, locks the tool on the stud. By turning the upper setscrew in the same direction as the stud, the tool is unlocked. Only one wrench is required to lock or unlock it.



Towels for Mechanics

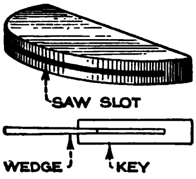
Printers, garage men and machinists are very hard on towels. The ordinary bath or crash towel quickly wears out under the treatment which it receives in the shop. If a mechanic cares more for utility and economy than for appearances, a more serviceable towel can be made from a grain sack. These sacks can be procured cheaply from a feed store. A large-size sack will make two towels.

To Remove Grease from Machinery

A good way to remove grease or oil from machinery before painting is to brush slaked lime and water over the surface, leaving the solution on overnight. After washing, the iron is dried and the paint will stick to it readily. In removing grease from wood, common whitewash may be left on for a few hours and then washed off.

Seating Woodruff Keys

To tighten a Woodruff key in its seat, a slot is cut into the key, as shown in the illustration, and a small piece of sheet metal, slightly thicker than the slot, and tapered on one edge, is forced into the slot, to expand the key. The edges of the sheet metal are then trimmed off, and the key is filed to an exact fit in the seat. This gives better results.—L. R. Butcher, Des Moines, Iowa.

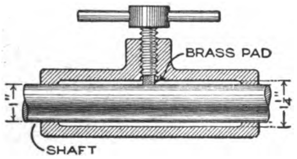


Catches to Hold Food Deck in a Dinner Pail

Occasionally my dinner pail would upset, and the food in the dinner deck push the cover off so that the contents would be spilled. To prevent this, I fastened two clips to the side of the dinner deck so that their upper ends would pass over the cover when the deck was pushed into the pail part and thus hold it firmly.—William H. Jones, Ladysmith, B. Columbia.

Tool for Straightening Steel Bars

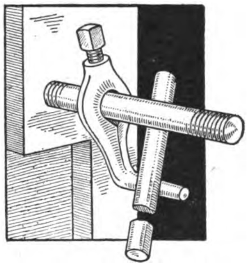
In a shop which uses much bright, drawn-steel bar, from which are turned small shafts, the usual method of straightening with a bar, after mounting the shaft between centers, is not found very successful. Moreover, it is bad for the lathe and lathe centers. To overcome this was the purpose of devising the bar straightener shown in the drawing. It is cheap, and can be quickly made, complete, by the lathe hand. This one is for a 1-in. bar, and was turned and bored from a 2¾-in. bar; the large diameter was used to provide ample thread distance for the straightening screw.



¶A large nut may be made to do for emergency service by hammering one side until the hole assumes an oval shape. The threads of the nut will take hold on two sides of the bolt and maintain the position until the right size can be procured.

Heavy Stud Bolts Removed with Lathe Dog and Lever

Machinists sometimes find stud bolts set so firmly that the ordinary wrenches and devices for removing them are insufficient. Under these conditions, a simple method is to attach a heavy lathe dog to the bolt, as shown, and apply an iron bar as a lever. Tremendous force can be applied in this way, and the bolt easily removed. By reversing the pull, the bolt can be set very firmly.—W. Ichler, Kansas City, Mo.



A Washer to Take Up End Play on a Shaft

A large gas engine developed end play in the crankshaft due to the wearing of the bronze bearing, and the occasional knocking of the flywheel, which weighed about 1 ton, became a serious matter. The wear was all on one side and it was decided to remove the flywheel and put in a bronze washer to take up all the slack. It was found that the wheel was so tight a fit that it could not be moved with the means at hand. Therefore the bronze washer had to be made in halves so that it could be put on the shaft. The washer was made oval in shape, Fig. 1, split, the ends beveled, and rivet holes drilled. By removing the cap of the main bearing on the side next to the flywheel, it was possible to get at the washer and rivet the two parts together. The completed washer, or collar, is shown in Fig. 2. By making the pattern for the casting in this manner, no boring or turning was necessary to finish the washer.—Donald A. Hampson, Middletown, N. Y.

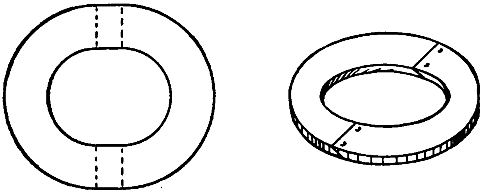
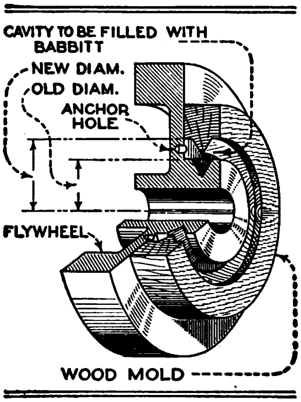


Fig. 1 Fig. 2

A Split Washer to Place on a Shaft Where a Wheel Could Not Be Removed

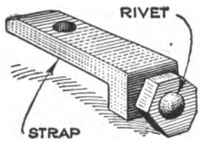
Increasing Diameter of Small V-Pulleys

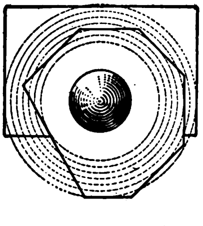
When it is desired to increase the diameter of a V-pulley, such as often found on the side of a small flywheel, a "rim" of babbitt can be cast around it, providing the increase in size is not too great.



Small anchor holes are first drilled in the side of the wheel, as shown. A wooden mold is then turned out of good dry pine to the new diameter. The mold is placed around the pulley, concentric with the bore, and clamped in place, after which babbitt is poured into the open space between the mold and the old pulley. If it is desired to use the old pulley again, it is only necessary to cut off or melt the babbitt. When melting the babbitt, whittle a clean surface on the end of a pine stick and dip it repeatedly in the metal. When the stick chars, pour the babbitt.

An Adjustable Machine Strap



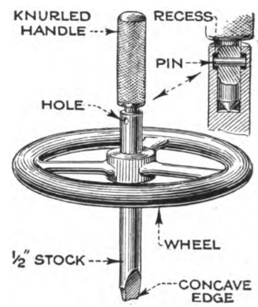


When strapping work down to machine tables, it is very convenient to have a little "adjustability" in the strap. If the work is of slight thickness, the strap alone may be sufficient without packing, but the principal object of the strap shown in the drawing is to facilitate setting it at the correct height without the usual bother of looking around for washers or pieces of scrap. The ordinary heel - type strap of the drawing has a hole drilled in the back, to which the angular machine-steel piece illustrated is riveted. The distances of the faces of these angles should vary by about 1/32 in., measured from the center. When in use, packing is put underneath the strap to approximately the right height, the final setting being obtained by turning the hexagon-shaped piece that raises or lowers the strap.—John Cox, Chicago, Ill.

Safety Block for a Bench Vise

In filing small pieces of material in a bench vise, or in attempting to hold pieces of peculiar shape, time otherwise lost in adjusting the piece may be saved by the use of a safety block. It should be made of hardwood and the end grain should be at the shorter edge, so that the heavy wear will be taken at that point. Carefully selected straight-grained stock is, of course, best for this purpose.

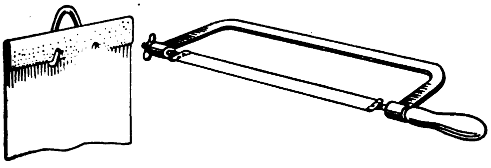
Screwdriver for Rapid Work



The novel screwdriver shown will be found a handy tool, in cases where a large number of screws are to be turned down, as in assembling operations of different kinds. Starting the screws by hand, as usual, they can be quickly spun into place and tightened. The blade is made of ½-in. stock, and is ground with a concave edge. The upper end of the stock is drilled out and flat-bottomed, leaving a small center only. Next, a recess is cut near the end, and a small hole is drilled through its center, as shown. Another piece of ½-in. stock is used for the handle, one end of which is turned down to fit loosely into the hole in the blade section. The small end of the handle is turned to a taper point, which runs in the center provided. A pin, a little shorter than the diameter of the recess, is driven into the handle and prevents the parts from becoming separated. An old valve wheel, or any wheel of suitable diameter, is then driven tightly onto the driver section of the tool, and, if necessary, further secured by a pin. With the screws all started in one or two threads, the screwdriver is placed on each in turn, a slight downward pressure being applied on the handle; this, together with the concave edge, holds the tool in place while the wheel is given a quick twirl which sends the screw home rapidly. A slight pull on the wheel seats the screw tightly.

Emery-Cloth Ends to Attach in a Hacksaw Frame

A strip of emery cloth, up to 2 in. in width, can be effectively used in a hacksaw frame, if the ends of the cloth are held straight to prevent creasing. This may be accomplished by folding the ends over a piece of broken hacksaw blade, then bending a wire clip, to attach it in the saw frame, over the piece of saw blade, as shown in the sketch. In this way a strip of emery cloth may be used like a file.—John Steen, Minneapolis, Minn.



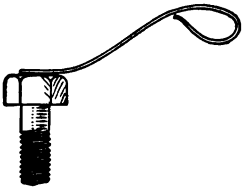
The Strip of Emery Cloth in the Saw Frame Is Used in the Same Manner as a File

Making Brushes for the Shop

Small wire scratch brushes find a variety of uses about the shop and home for cleaning rusted metal surfaces, spark plugs, and other articles, and, similarly, bristle brushes are widely useful for applying soldering acid, cleaning commutators, etc. Such brushes, of either wire or bristles, are easily made by inserting a bundle of wires or bristles into a short length of metal tube.—George S. Stevenhoffer, West Allis, Wis.

Starting a Bolt in a Difficult Place

Recently, while working on an automobile, I found it difficult to get a bolt started in its place, and when I had about decided to remove other parts to enter the bolt, I hit upon the following scheme of overcoming the difficulty: A piece of wire was procured and one end lightly soldered to the bolt head. This served as a handle for placing the bolt and was easily removed by giving the wire a few turns. The same means can be used to enter bolts and pins in places not easily accessible, the time of preparation being small as compared with the practical value of the device.—Wm. A. Murry, Cold Spring, N. Y.

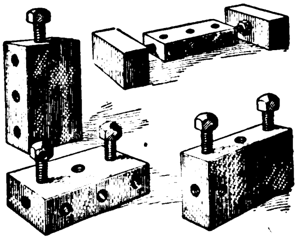


Gummed Paper in Machine Shop

There are many cases when small machine parts must be held together temporarily, for example while screws are being put in, or while adjustments are being made. In one shop, several widths of gummed paper, in rolls, are kept for just this purpose. The sticky tape is quickly and conveniently bound around any part and holds against moderately severe strains.

A Handy Block Jack

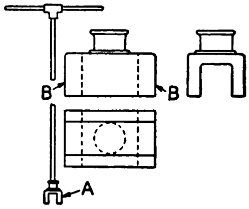
The type of jack shown in the drawing has been found exceedingly useful in an eastern machine shop. It is very easily made, consisting only of a block of machine steel, drilled and tapped, as shown, and provided with a couple of machine screws. The block and screws may be casehardened, if desired. This jack provides a number of different heights, according to the surface used, and, by using a screw at each end, as shown in the upper right-hand drawing, its usefulness is still further increased.



A few jacks of this kind, made up and kept around the drilling machine, shaper, or miller, will more than repay the time spent in making them, since the operators need waste no time in hunting for packing blocks of the proper height.—C. H. Willey, West Springfield, Mass.

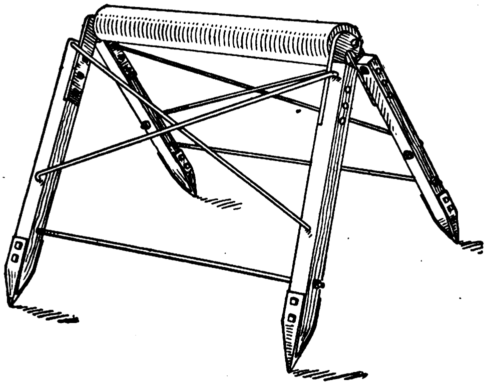
Extension Wrench

The wrench end A consists of a hydrant clamp, tapped for a ⅜-in. pipe. The ends BB of the clamp are cut off, and a length of ⅜-in. pipe threaded on both ends to receive the clamp and a ⅜-in. tee. Two 6-in. lengths of pipe are screwed into the tee for a handle. The hydrant clamps can be procured in a variety of sizes and one can be selected to fit any of the common nuts.—Charles Webber, Chicago, Ill.



Adjustable Horse for the Shop

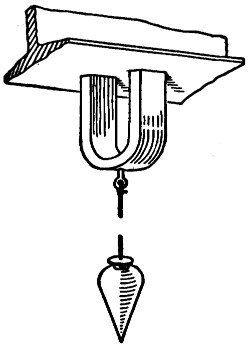
Two necessary points in the construction of an adjustable horse are the ease of adjustment and the rigidity of the base. In most cases one is sacrificed for the other. The accompanying sketch shows the construction of about as handy an arrangement for general use as can be made for a wood-working shop. There are no parts with setscrews to come loose and allow the work to fall. The jack is instantly set and, because of the extent of the base, it remains where set under a load, regardless of the tendency to tip as the work is moved either way over the roller.—F. W. Bently, Huron, S. Dak.



Roller with Adjustable Legs

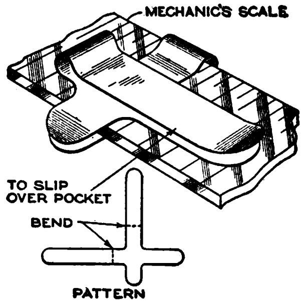
Magnetic Plumb-Line Holder

A handy little device for holding a plumb line is shown in the sketch. It is especially valuable to one working alone around iron structures or in places where a plumb line cannot be tied to iron work. It consists of a rectangular piece of tool steel bent to a U-shape, the ends squared and a hole drilled in the center of the bend for a screweye. After hardening, the screweye is riveted in place and the steel magnetized. The size of the magnet will depend upon the weight of the plumb bob used.—M. J. McGall, W. Orange, N. J.



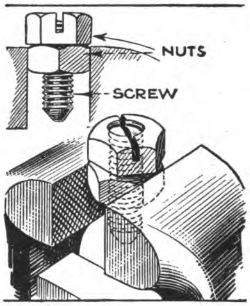
Pocket Clip for Steel Scale

A practical device for holding a mechanic's scale, or similar flat article, to prevent it from falling out of the pocket, is the clip shown in the drawing. It is a common experience with machinists, and others, that the heavy metal scale will almost invariably drop out of the pocket every time they bend to pick something from the floor. The drawing shows the pattern from which a clip, as neat and handy as a fountain-pen clip, is formed. Sheet metal is used, bent and formed to fit over the scale in the manner indicated.—Warren D. Ferris, Buffalo, N. Y.



Making Headless Setscrews

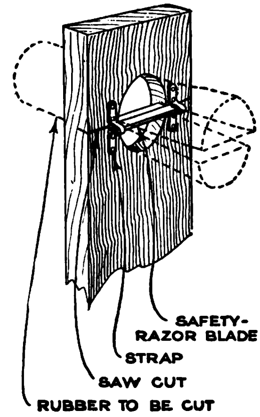
Headless setscrews can be made by the amateur mechanic by cutting off the heads of machine screws or cap screws, and cutting the slots with a hacksaw, but, unless some method of guiding the saw is used, it is difficult to make a neat job, especially in the smaller sizes. A fixture that eliminates this difficulty consists of a nut fitting the screw to be slotted, and having a slot cut across it to a depth about twice that of the desired slot in the screw. After cutting the slot in the nut, it is hardened. In use, another nut is first run onto the screw; the slotted one is then screwed down against the first, and tightened, the screw head coming about the center of the slot, and the nuts are then gripped in a vise, as indicated. A number of these fixtures, made for various sizes of screws, will be found to be of great convenience.



¶It has been found that a stick wedged into the slot will sometimes aid in starting machine screws.

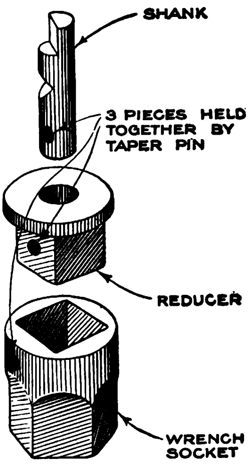
Fixture for Splitting Round Rubber

Almost everyone knows the difficulty of attaching round rubber to a flat surface so as to make a neat job, and splitting the rubber so that the cut surface will be even is also difficult. The simple fixture illustrated herewith shows how the latter can be done quickly and neatly. A hole to accommodate the rubber is drilled in a board, and an old razor blade is fastened securely into a groove provided for it on one side. The operation is started by slitting the rubber for a few inches with a knife and then inserting it in the fixture and pulling it through from the back.—Frank Jablecnik, Chicago, Ill.



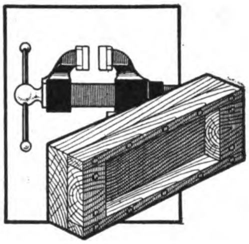
Wrench Attachment Makes Speed Wrench of Spiral Screwdriver

The spiral screwdriver may be converted into a convenient speed wrench by using the attachment shown in the drawing. A reducer is made from a piece of round stock to fit into the wrench socket, as indicated. The flat end is cut off one of the screwdriver bits, and the shank is inserted into a hole drilled in the top of the reducer. The three pieces are assembled and a hole drilled through them, as shown, to take a taper pin, which holds all three pieces together. Such a wrench will be found very convenient for turning down a large number of bolts or cap screws of the same size, and wrench sockets as large as ⅜ in. can be used in this way with a satisfactory speeding up in operation.



Wooden Caps Convert Machinist's Vise into Bench Clamp

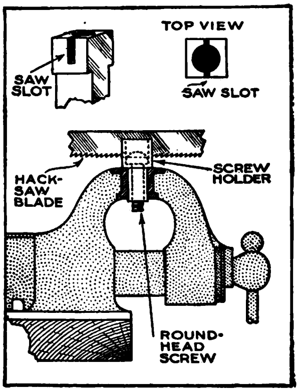
In most carpenter shops a machinist's vise is provided, and it is often desirable to use this for finishing small pieces that are difficult to hold in an ordinary bench vise. By providing the machinist's vise with wooden caps, as illustrated, work may be clamped securely without marring it. A pair of such caps may be quickly made from waste material. Any good hard wood will do. The finished caps should be lined with leather to prevent splitting of the wood, and to provide the slight resiliency necessary. — Charles Barker, Uniontown, Pa.



Screw-Slotting Fixture for the Vise

The experimental worker must make many of his own screws, and naturally this involves slotting the heads. Squeezing the screws in a vise is unsatisfactory either because the slot is not centrally located, or because the thread is damaged.

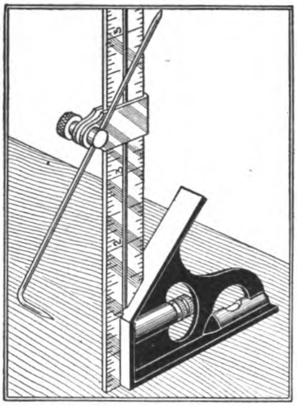
A simple little fixture for this purpose can be clamped in the vise, and the screws slotted quickly and accurately. A block of tool steel is used, and a hole is drilled through it to take the screw, the upper part being counterbored to the size of the heads. A saw slot is then made through the exact center of the larger hole and a trifle lower than the depth required. The fixture is finished by hardening.—J. V. Romig, Allentown, Pa.



¶A good rust preventive, and one which is extensively used, is banana oil, which can be obtained at any drug or paint store. First polish the article and then apply the oil, using a soft brush.

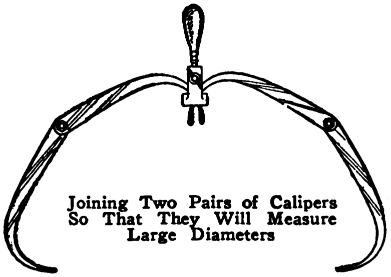
Surface-Gauge Attachment for Square

An adjustable square of the type shown, or an ordinary try-square, may easily be converted into a handy surface gauge by means of a simple attachment. All that is required is a piece of thin steel, about 1/16 by 1 by 4 in. long. This is formed into a clamp that fits around the scale of the square, and is fitted with a binding screw for clamping it in position, and with a scriber. An attachment of this kind saves the cost of a regular surface gauge and is just as satisfactory.—Arthur J. McElhose, Arlington Heights, Ill.



Enlarging the Capacity of Calipers

It is not an uncommon occurrence in the routine of general lathe work, to come across some work with a diameter too great to be measured with the largest pair of calipers in the tool kit. The sketch shows how to fasten two pairs of calipers together with a hand vise to increase their reach for measuring large diameters. The hinges on both pairs of calipers can be brought into use while on the work, and when rigidly clamped together by means of a small hand vise, the arrangement is as practical as a large, heavy pair of calipers. The adjustment is made with the two extending arms.

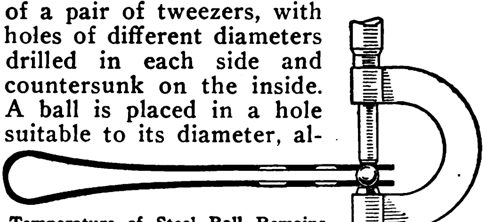


Joining Two Pairs of Calipers So That They Will Measure Large Diameters

ℭA machine bolt is usually screwed down 2½ times its diameter.

Calipering Steel Balls

A method used to caliper hardened steel balls is shown in the accompanying sketch. A piece of spring steel is bent in the form of a pair of tweezers, with holes of different diameters drilled in each side and countersunk on the inside. A ball is placed in a hole suitable to its diameter, allowing it to project so that there is no interference with the calipering.

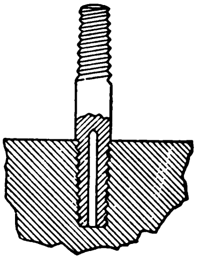


Temperature of Steel Ball Remains Normal; Thus True Measurements Are Obtained

By using the tweezers the heat of the hand does not cause the ball to expand, thus the true diameter may be easily determined.

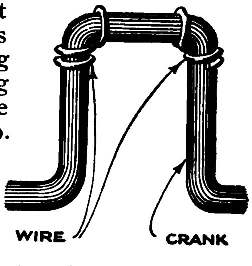
Small Hole in Stud Bolt

A broken stud presents a difficult job to repair. The remaining end is hard to remove without doing damage to the threads in the metal where it is fastened. A very good plan is to drill a small hole in the stud when making it; then, if it breaks, it is not a hard job to make a large drill follow the small hole, and a drift can be used in turning out the shell.—Frank G. Carpenter, San Francisco, Calif.



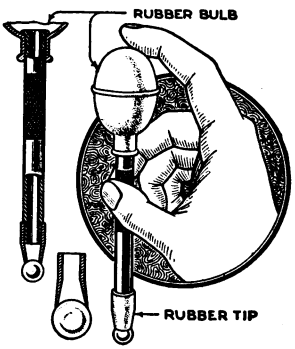
Making Crankshafts for Model Work

When making light crankshafts from heavy wire or light rod, for experimental or model work, it is usually found that there is more or less sideplay and binding in the connecting rod, owing to the formation of the web. This defect can be overcome by applying coarse wires as shown in the drawing. If facilities are available, the job can be made neater and more substantial by brazing or soldering the wire to the shaft.—J. McCormack, Haliburton, Ont.



Handling Small Balls

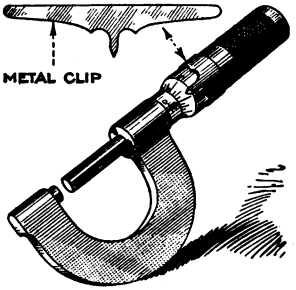
The tool shown in the drawing makes the handling of small balls an easy matter, and can easily be made from a short length of brass or steel tubing. The outside of the tube may be knurled or not, as desirable. A small shoulder is turned on one end of the device, to prevent the rubber bulb from slipping off. Various kinds of rubber tips can be made to meet special requirements, two styles being shown in the drawing, one for small balls and the other for larger ones.



To pick up a ball, the bulb is compressed and the tip is placed over the ball. On releasing the bulb, the suction causes the ball to adhere; to drop the ball into position, the bulb is compressed and the ball is left on the spot you want it.—Norman Hazen, Montreal, Que.

Quick-Reading Micrometer Attachment

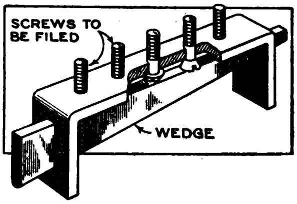
A circular clip, that fits closely around the thimble of a micrometer, will be found very useful when turning or grinding a number of pieces to the same size; by means of this, the mechanic is enabled to read the instrument at arm's length, avoiding the usual bending over the machine. The clip is made of sheet metal, and is formed so that it will have enough tension to grip the thimble of the caliper tightly. The pointer is set at the proper graduation on the thimble, making the subsequent reading of the caliper a very simple matter.—Percy W. Thomas, Beloit, Wis.



¶A machinist must remember that the warmth of the hand will change the size of a caliper or gauge of any kind.

Clamp for Filing Screws

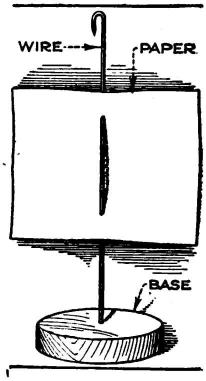
When it is desired to shorten a screw, the usual method of holding it in the vise, in addition to damaging the head, often tries the patience of the machinist. The simple tool shown in the drawing greatly facilitates the shortening of screws, holding them firmly during the process.



A piece of flat cold-rolled steel is bent and slotted to take the wedge that locks the screw heads. The holes in the steel need not be threaded, the screws being merely dropped into place and the wedge tapped home.

Stand for Light Testing Work

White paper makes an excellent background for testing work by the light method. In the illustration a stand is shown that was made especially for this purpose. This stand holds the paper so that it can be slid up and down to suit the operator, and also be turned around to any position to reflect the light. The base of the support is a slab of round stock, in the center of which is driven a length of 1/8-in. wire, sharpened at one end and bent over as shown, to eliminate the chances of an accidental scratch. When using squares, center gauges, straightedges, or similar tools used for testing the shape of work this stand will be found to be of considerable assistance, as it does away with the necessity of setting the paper up against different objects to obtain the correct light.—Andrew Jergens, Waterloo, Iowa.

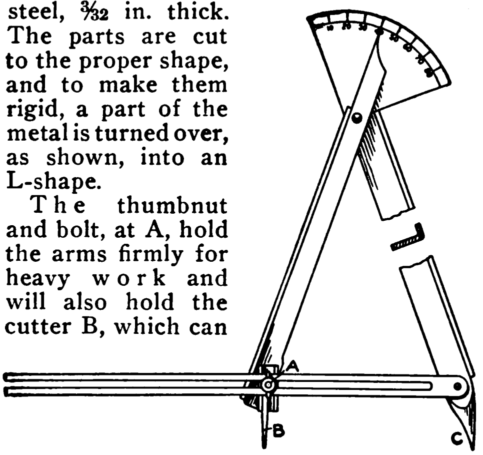


¶A piece of heavy cardboard, about 6 in. square and having a 1/2-in. hole through it, is useful in locating splinters or small particles of foreign matter in the hand. Hold the hand in front of a strong light and locate the splinter by observation through the opening.

A Disk Cutter

The cutter is made similar to a pair of dividers—in fact, it can be used as dividers and as a bevel protractor—from sheet steel, 3/32 in. thick. The parts are cut to the proper shape, and to make them rigid, a part of the metal is turned over, as shown, into an L-shape.

The thumbnut and bolt, at A, hold the arms firmly for heavy work and will also hold the cutter B, which can be set at any angle. The end C is filed to a sharp point. A protractor scale is laid out and marked with a sharp-pointed tool.

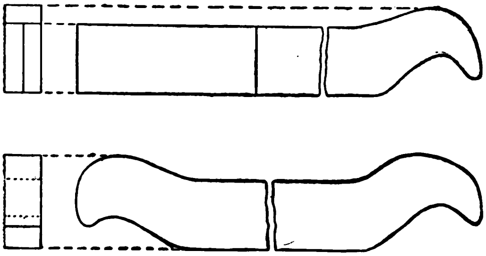


A Disk Cutter That Can Be Used Also as Dividers or as a Bevel Protractor

The tool I made had 9-in. arms and a connecting slot bar, 6 in. long. It cuts disks or washers from cardboard, leather and boards of soft pine or poplar. I find much use for it.—John V. Loeffler, Evansville, Ind.

Key Bars

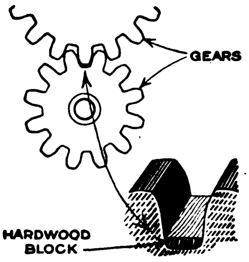
With two key bars of the shape shown in the illustration the work of fitting and removing keys from flywheels, driving gears, etc., becomes an easy task. The bars may be used for either large or small keys and are both made of tool steel, 5/8 in. thick, 1¼ in. wide and 2½ ft. long. These are forged into the shape shown and tempered.—George Jager, Woodside, Long Island.



Key Bars for Removing Keys in Shafts Carrying Flywheels, Gears and Pulleys

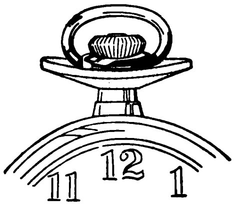
Gauge for Gear Setting

A firm which sends out machinery to be erected, experienced much annoyance from the fact that gears were often set up with improper clearance, thus increasing wear and tear. The difficulty was overcome by an idea obtained from a draftsman; his suggestion was to send out with each gear a small hardwood block whose thickness represented exactly the clearance to be allowed between the tip of the tooth on one gear and the root of the other gear. By the use of this block a workman without great skill in millwrighting was enabled to space the gears so as to have the clearance exactly right.—Harry C. Vanderhorst, Tarrytown, N. Y.



Safety Collar for Watch Stems

A simple manner to protect a watch from dropping out of the pocket where it is carried is shown in the sketch. About a shop where a person is continually stooping in the performance of work, the watch often drops out of the pocket, and, if held with a chain, it is liable to strike against something which may result in a damage that will be of considerable expense to the wearer.

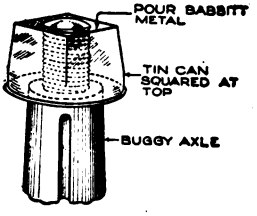


A small rubber washer is slipped over the stem just below the chain ring and prevents the watch, by its own weight, from slipping out of the pocket by engaging the surface of the cloth. The washer can be cut from rubber of almost any kind and drawn into the cupped shape by the application of heat to its center. The arrangement is a trifle unsightly, but as it is worn only about a shop, it is worth while in the saving of many crystals and other damage to a valuable watch.

¶ Setscrews can be tightened without the usual danger of twisting them off, if the heads are lightly tapped with a hammer while drawing them tight with the wrench.

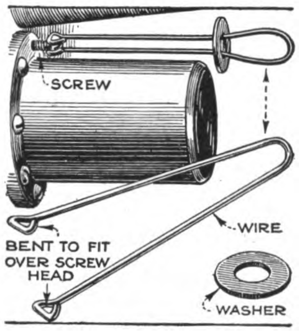
Emergency Nut Cast of Babbitt

When a nut, especially a large one, of a certain size must be had for repair work, and is not to be found, a good way is to make one from babbitt. In the case illustrated, a portion of a tin can was bent up to a shape approximating that of the nut desired. A hole was made to fit the thread of the axle, and the can was set in place to form a mold. After greasing the threads and the mold with an oily rag, babbitt metal was poured into the mold. When cool, the tin is torn away and a nut remains, which, if it has not the strength of a steel nut, will often give good service. The process is especially useful when a nut with a left-hand thread is required, as left-hand taps of the required size are less likely to be found handy than right-hand taps, while the babbitt nut can be used in either case.—W. J. Mahnke, Coeur d'Alene, Idaho.



Simple Screw Holder

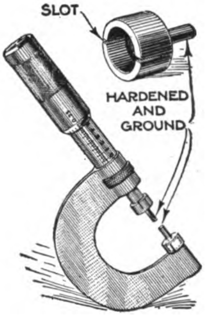
Although there are a number of tools for starting screws in places that are nearly inaccessible, the tool shown in the illustration would be hard to beat for simplicity, and can easily be made, in a few minutes, from a length of heavy galvanized wire and a washer. The wire is doubled as shown in the lower detail, the ends bent over to fit the screw head, and the washer slipped over the doubled end, after which this end is widened to prevent the washer from coming off again. In use, the ends are slipped onto the screw head, and the washer moved down to clamp the screw.—Andrew Wilson, Santa Rosa, Calif.



¶A piece of paper placed between finished metal surfaces keeps them from sliding.

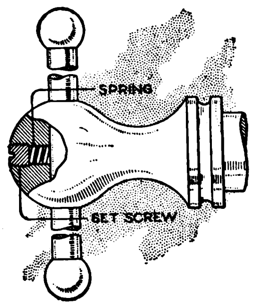
Auxiliary Tip for Micrometer

The drawing shows an attachment for micrometer calipers that will be found very useful when calipering narrow slots, or places that are not easily measured without their use. Either or both anvil and rod can be fitted with these caps, which are turned, hardened, and ground to the form shown. The inside diameter is a trifle smaller than the diameter of the parts they fit over, but by slotting them as shown, they make a close fit.



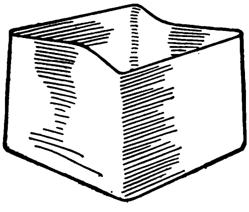
Friction Lock Keeps Vise Ball Point from Injuring Fingers

Pinched fingers, such as frequently result from the ball points of a vise dropping on a workman's hands, may be avoided by the installation of a friction-locking mechanism, as illustrated. The spring and set-screw can be located on any convenient part of the vise screw. The shifting lever should be removed to make the addition.—George F. Kuhne, East Rutherford, N. J.

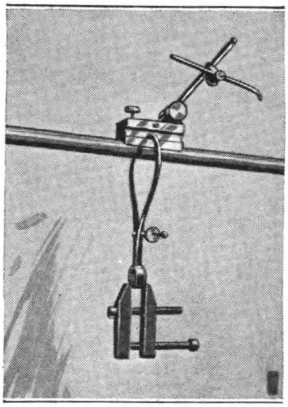


Replacing Paper-Box Covers

The replacing of a cover on a paper box is not easy, especially if it contains small heavy articles, such as screws or small nuts. Many articles in the hardware trade are put up in these boxes. A little trick that will enable anyone to quickly cover the box is shown in the illustration. Push inward slightly on the sides of the box to bend them in, as shown, and the cover will slip on easily.—George F. Dobbins, Beatrice, Nebr.

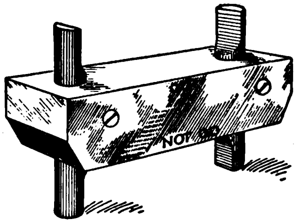


Holding a Surface Gauge



When a surface gauge is used on round work, it often happens that the gauge is forgotten on the work, with the result that it topples over and falls to the floor. As a precaution against this, a mechanic employed the method shown in the photograph. A pair of spring outside calipers were adjusted to grip the finger depressions on each side of the surface gauge, and a parallel clamp was fastened to the calipers to act as a counterweight.

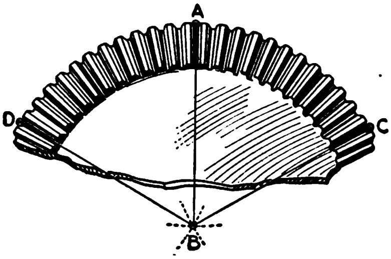
A Simple Limit Gauge



As a general rule, limit gauges are more or less expensive, but the drawing shows a simple gauge of this type that is also cheap to make. The block that forms the body is made of ordinary carbon steel, but the pins are, of course, of hardened tool steel. One side of the pins is ground off to the "not-go" size, while the other gives the minimum limit of tolerance, or "go" size. Two screws serve to hold the pins so that they can be removed and replaced by pins of different size, as may be necessary, thus making the one block serve for more than one gauge.—J. H. Moore, Toronto, Ont.

Finding Gear Diameter with Only a Broken Piece

It is often necessary to find the diameter of a gear of which only a piece of the rim remains. This can be accomplished as follows: Place one point of the dividers on the extreme circumference, at A, and strike an arc near the center at B; then set one point of the dividers on the right side, at C, and strike another arc at B, being careful not to change the dividers. Do likewise on the point D. The point where the three arcs intersect at B will be the center of the gear, from which the diameter may be found.—Russel E. Hollis, Chicago, Ill.



Locating the Center with Dividers to Find the Diameter of a Gear

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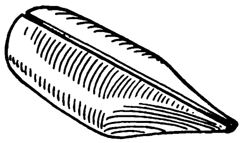
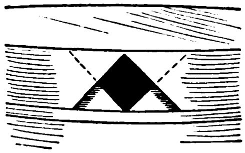
Oil Spout Formed in a Bottle Stopper



Having occasion to use an oilcan when none was at hand, I constructed a substitute by forming a spout in the stopper of a bottle. An ordinary bottle of the smaller size was selected and a wood stick, about 4 in. long, was whittled to fit in the neck of the bottle. The outer end of the wood was cut pointed, and a V-shaped groove cut in the side from the pointed end to the base. The oil will run along the groove and can be dropped into a bearing as well as with an ordinary oilcan.—Arthur Koeppner, Cleveland, Ohio.

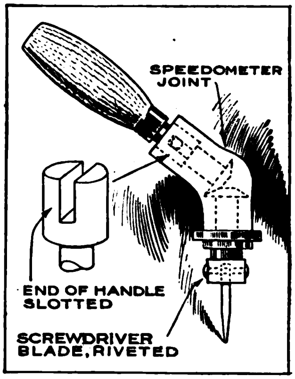
A Box to Hold Powders



The mechanic's receptacle for holding any one of the powders, like emery or borax, that are occasionally used by him consists of a small pasteboard or metal box. One of the handiest receptacles for any powder is a tin can, with close fitting cover, prepared as follows: A V-shaped notch is cut in the cover, and one in the can, in opposite directions. A slight turn of the cover makes an opening which can be increased in size up to the limit of the cuts. The opening is closed by turning the cover.

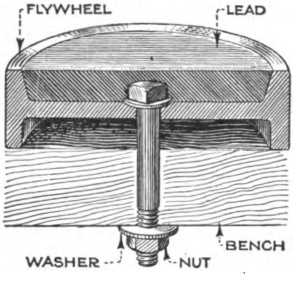
Geared Offset Screwdriver

A screwdriver, for use where the space above the screw head does not permit the application of the usual straight-handle type, is made, as shown in the drawing, from a speedometer joint, in which two bevel gears rotate shafts held at an angle to each other. There are usually two such joints on each speedometer, at the points where the flexible shaft is connected. The joint is modified by riveting a screwdriver blade to one end and fitting a handle to the second shaft, as indicated. In use, the casing about the gears forms a convenient hold for the palm of the left hand, while the right hand is used to turn the handle.



A Soft-Metal Anvil

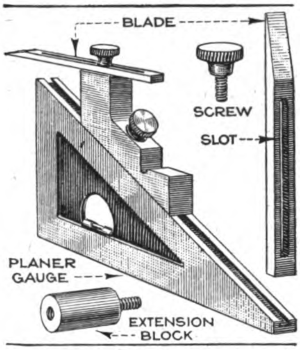
The mechanic frequently needs a soft yet firm surface against which to hold polished or plated work without danger of marring it. A convenient bench anvil of this sort may be made from an old automobile flywheel. The flywheel is fastened to the bench by a bolt passing through the bench top, the head of the bolt being on top, so that the fixture can be removed from the bench when necessary. The anvil is completed by filling the hollow upper surface of the wheel with melted lead, flush with the rim. When the surface of the anvil becomes too much battered, the lead can be removed, remelted, and poured back again.



The surface of cement floors may be cleaned of oil for making repairs by a few applications of muriatic acid.

Height Gauge Made from Planer Gauge

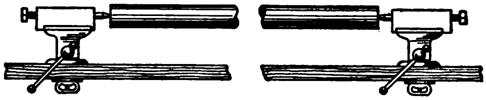
The addition of a blade to the common planer gauge provides the mechanic with a very satisfactory height gauge. The blade is made of tool steel, ground to a knife edge, as shown, slotted, hardened, and tempered, and the bottom surface ground true. The knurled screw that fastens it to the gauge has a thread of the same size as the regular extension blocks for the gauge. The gauge is set, in the usual manner, with an outside micrometer, and the blade then clamped in place. With the use of the extension blocks, the gauge has quite a wide range of adjustment.—G. W. Nusbaum, Takoma Park, D. C.



Testing Rollers for Straightness

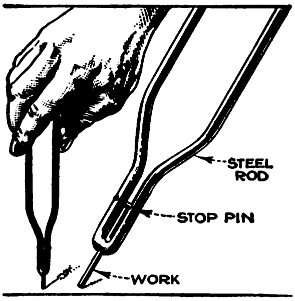
A mechanic was asked to straighten some long rollers of a printing press that had been bent, and having no lathe long enough to take in the rollers, he was momentarily at a loss how to test them after in part straightening them. However, he hit upon a plan that was as good as it was simple. It is illustrated in the sketch.

The workbench was supplied with two vises about 8 ft. apart. In each of these was placed a large center used on the planer. When they were tightly gripped by the vise jaws and approximately lined up they were as good as the lathe centers for the work. A block on the bench brought up close to the roller showed exactly the high spot when the roller was turned by hand. Repeated bendings at the high spots, followed by checking or testing between centers, produced a most satisfactory job. This simple plan may be applied to many other jobs.—Charles V. Farr, Burbank, Calif.



Testing Long Rollers for Straightness by Placing Them between Centers Clamped in Vises

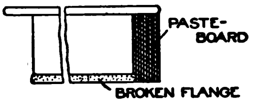
An Easily Made Pin Setter



The drawing shows a handy tool for setting pins in places where the fingers cannot reach comfortably. The dimensions of the tool depend, of course, on the diameter and length of the pin to be driven in, the one illustrated being made of $\frac{3}{16}$-in. round stock, bent to the shape shown, and drilled in the end to take a pin. It is also drilled through for a stop pin, which fits tightly in one side and loosely in the other. In use, a pin is slipped in the hole at the end, until it touches the stop pin. Then by grasping the holder in the hand as shown, the pin can be pushed in place.

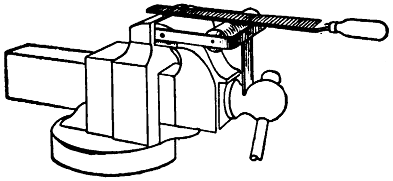
Repairing Broken Flange Pulley

Some repairs had to be made on a sawmill located in the woods about 20 miles from a station. There was found among the broken parts one 18-in. flanged pulley with one flange broken off and three arms cracked. As time and price were considered above appearance, a new wood pattern was out of the question. The old pulley was broken beyond repair, but it had value as a pattern. About 30 ft. of pasteboard, $\frac{1}{8}$ in. thick, was procured and cut into strips, 4 in. wide. These were laid on the face of the pulley and coated with shellac, and each layer tacked to the previous layer. When the space was filled to the size of the flange the wheel was ready for the molder. In this case the rim was cast solid and the metal turned out to form the two flanges.



Vise Guides for Filing Flat Surfaces

When it is desired to file a perfectly flat surface in a vise, the attachment shown in the sketch will greatly assist the filer to that end. The device is made of a strip of iron, about $\frac{1}{4}$ in. thick and 2 in. wide, and bent as shown. This is fitted with a suitable roller turned from wood and fitted with a steel axle to run freely between the arms, and the ends of the arms pivoted on pins set in the sides of the outer vise jaw.

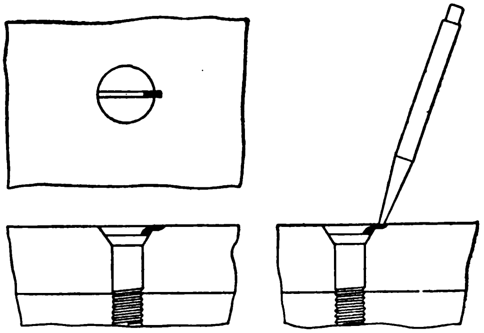


Roller Attachment to Keep the Surface of the File on a Perfect Level

A metal standard is attached to rest on the vise screw to keep the roller in position. The manner of using the file over the roller is obvious.

Locking Screws in Metal

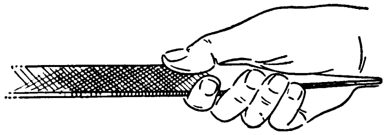
A flat-head or fillister-head screw can be easily locked in metal by driving a portion of the material into the slot of the screw. After turning the screw home tightly, the metal is driven in with a small flat chisel or drift, as shown in the illustration.—F. G. Marbach, Cleveland, Ohio.



A Portion of the Metal Is Driven into the Screw Slot, Which Locks the Screw

Holding a File without a Handle

Accidents without number have occurred from running the tang of a file into the hand. It is always best to have a handle on the file, but if none is at hand, the file can be safely held as shown in the sketch. It will be noticed that the tang end is not in the hand, and that the

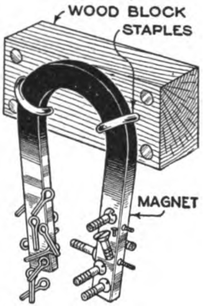


Manner of Holding a File without a Handle to Prevent Injury to the Hand

hand grasps the file a little farther up, so that if the wrist is turned slightly away, no injury will result even though the file receive a blow on the end. Filing without a handle on work in the lathe is most dangerous of all, but is perfectly safe if done in the manner described. Apropos of filing without a handle, it is interesting to note that filing absolutely perfect flat surfaces in a vise is best done without a handle. The extra length of a handle means extra leverage, acting opposite to filing flat.

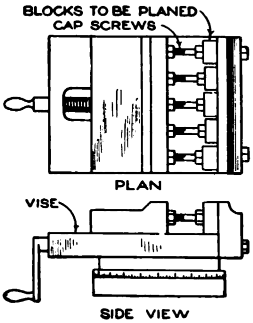
Magnet Holds Screws and Cotters

An assortment of small screws and cotter pins can be kept so that there is no danger of spilling them over the bench, when a can or box is upset, by using a simple horseshoe magnet, preferably one from the magneto of an old car. The magnet is fastened to some suitable support with staples and the right size of screw or cotter is before the mechanic at all times. It is, of course, understood that the magnet will not attract screws or pins made of brass or copper, or of other nonferrous metals.



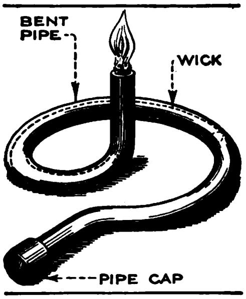
Holding Rough Work in Vise

Our shop had a job of planing 30 small steel blocks, about 2 in. long, and we had no jig suitable for holding them on the shaper. We could not hold more than one at a time in the vise, as they were forged to different sizes; the vise would tighten up on one or two, and the rest would be loose. In order to hold several of the blocks in the vise at once, we placed against each one of them a 1/2-in. cap screw, with a nut which rested against the vise jaw. Each nut was tightened until the block was held thoroughly tight, an effort being made to get each screw just as tight as the others. The vise was then tightened, clamping each block very tightly. In this way, five blocks at once were handled.—Joseph F. Convery, Worcester, Mass.



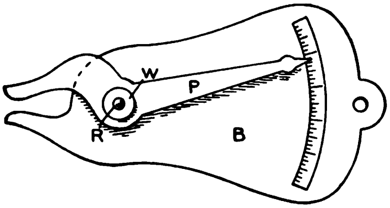
A Simple Torch

A simple torch that is very serviceable for many purposes can be made in a short time from a length of pipe, bent to the shape indicated. The pipe is threaded on one end, and is fitted with a cap that can be unscrewed to fill the torch with fuel. A cotton wick, about half as long as the pipe, is twisted into the other end. The circular form of the torch prevents it from upsetting and allowing the oil to run out.



Indicating Outside Caliper

The illustration shows how a simple indicating outside caliper may be made. The writer constructed a caliper like this from 1/16-in. sheet steel, and found it to be very useful in determining the diameter of small rods and wires. Care should be exercised in attaching the pointer P to the main portion, or base, B, to see that there is no lost motion in the joint. A small washer, W, may be placed on each side directly under the head of the rivet R. The scale should be ruled off last, and may be marked to read in fractions or decimal parts of an inch, or both. A second scale giving the gauge numbers will be very convenient in determining the size of wires.—R. S. McClure.



Caliper Made of Sheet Steel for Determining the Size of Small Rods and Wires

❡Adjust a bearing after taking up the wear so the strain of the bolts does not come on the journal, but on the faces of the bearing lines.

Water-Spray Air Cooler for the Shop

By J. HORACE VAN NICE

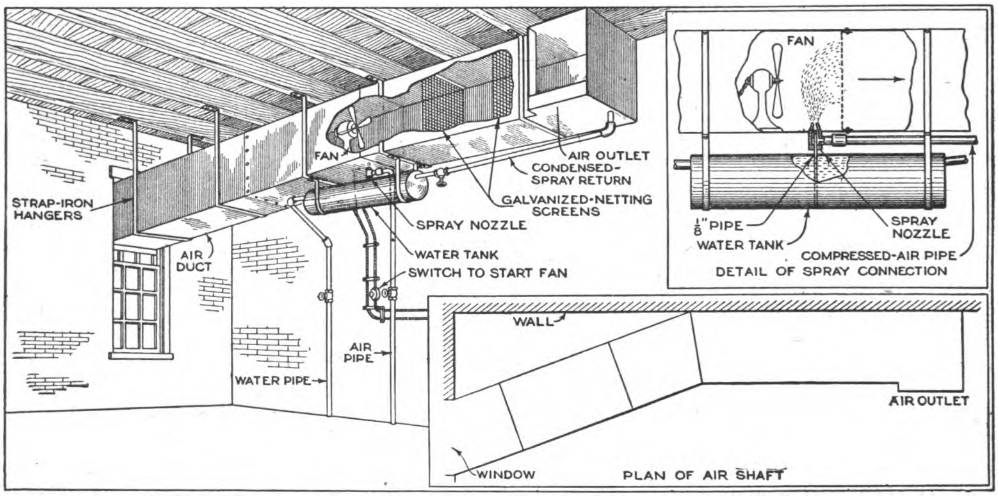
THE problem of keeping the temperature of a small shop at working level during the summer months is not difficult to solve with materials usually at hand. A little planning, and a few hours' work, will suffice to provide an air cooler that will make work pleasant and more efficient, even in an upper room under a tin roof. The expense should not be prohibitive, for the device is simple, and can be made right in the shop.

Evaporation of water, by passing a current of air through a fine spray, furnishes the cooling principle of the device. The air current is obtained by placing an electric fan in an air duct extending from an opening in the wall, or a window, to a point about midway of one wall, near the ceiling. This directs the cooled air to a point whence it circulates downward, and outward, thus changing the temperature of the whole shop.

For a small shop, an air shaft, 2 ft. square, will suffice. It should be made of galvanized iron, light-gauge sheet being satisfactory if the air duct is supported properly. The length of the duct, and the position of the opening, will depend on the size and shape of the shop. In any case, direct the opening out into the room, and not downward. Support the air duct by bending strap-iron bands around it, screwing the ends of the bands to the ceiling.

Two types of water spray may be used, either of which is efficient. The simplest method is to place a hose nozzle about 1 ft. in front of the place provided for the fan. The nozzle must be regulated to give a very fine spray when the water is turned on full force. This nozzle is then connected to the shop water supply by either pipe or hose, with a valve for closing the line. The second method, illustrated in the detail drawing, is perhaps a little more efficient, especially for the larger cooling systems, and is almost necessary where a pressure water supply is not available. This second type of sprayer is really an atomizer, operated from a water tank and from the shop compressed-air supply. The air is supplied to a nozzle in the air duct, placed as directed above. The water tank is connected to this nozzle by a ⅛-in. pipe, which enters the tee connection, and is flattened out slightly in the nozzle itself. When the air is turned on, it creates a vacuum in the water pipe, which draws water from the tank to the nozzle. It is then blown out in an exceedingly fine spray. This is in turn blown down the shaft by the current from an electric fan, placed about a foot from the nozzle. The air evaporates the water, and the current emitted at the outlet will be many degrees cooler than the air sucked in from the window, or other opening.

An ordinary 12 or 16-in. electric fan is sufficient for the small system described



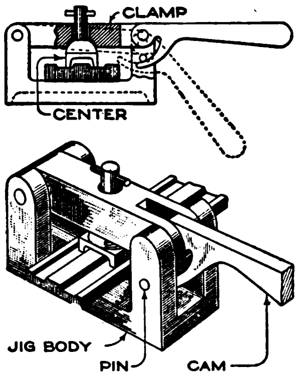
The Shop Which Has Electric Current Need Not Be Without Means of Providing Cool, Moist Air. In This Arrangement, the Cooling Power of the Fan Is Supplemented by the Effect of Evaporation of Water, Resulting in a Supply, at Low Cost, of Comfortable Air for Hot-Weather Work here. For a large shop, a regular ventilating fan should be used, and the size of the shaft increased.

Two screens of galvanized-wire netting, placed about 2 ft. apart in the air shaft, will aid in breaking up the spray, and thus in cooling the air current.

Whether the ordinary nozzle spray, or the compressed-air spray is used, the duct should slope slightly toward the air outlet, to allow the spray to collect, and to drain off. In the case of the compressed-air spray, the condensed water is returned to the tank for re-use. If water is used under pressure, the drain pipe should lead outside the building.

Quickly Operated Jig Clamp

A quickly operated jig clamp is shown in the drawing. The clamp is made with four lugs, one at each corner, with the swinging leaf pivoted between two of them, the actual clamping being done by means of the cam-and-pin arrangement shown in the sectional diagram. In order to be sure of accuracy, the work is held by a floating foot, or center. A pin, driven through a hole in the top of the center shank, prevents it from falling out, and the center is ball-shaped so that it can adapt itself to the surface irregularities of the work.



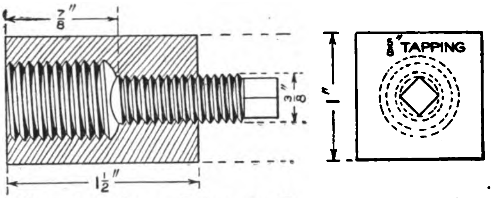
An Inexpensive Universal Joint

In the case of light and medium-heavy machinery, a very cheap, durable, and efficient universal joint may be made from three straight chain links of round section. In connecting this form of a joint, one end of each shaft, the driving and driven, must be slotted, to receive the end link, and a bolt put through the shaft to prevent the link from pulling out. A reinforcing collar is shrunk over the end of the shaft to strengthen the slotted part.

Such a joint will drive at almost right angles and with very little friction. It is especially recommended for mining, lumbering, agricultural, and similar classes of machinery.

A Stud Driver

When setting studs, the common practice is to put two nuts on the stud and screw them up until they are well locked together. This frequently injures the thread, but such damage can be avoided by making a stud driver similar to the one shown. For a ⅝-in. stud a piece of 1-in. square stock is suitable. This is drilled and tapped out ¼ in. deeper than the diameter of the stud. A ⅜-in. hole is also drilled and tapped through from the top. This small hole allows a pin to be screwed through and come down on top of the stud, thus preventing injury to any threads on the stud when it is screwed in.



Dimensions for a Driver to Turn ⅝-in. Studs into Place without Damage to the Threads

Square-Point Center Punch Handy for Revising Marks

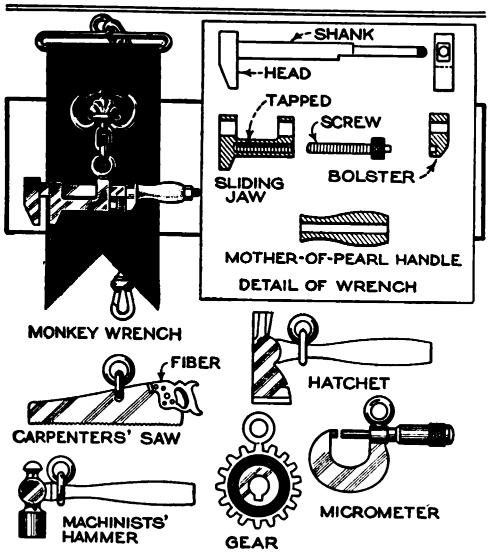
In laying out work in the machine shop, or other metal-working shops, it is customary to indicate centers and other points by means of center-punch marks. The punch is usually ground to a conical point, and it is difficult to distinguish various groups of markings, and especially revisions. A practical kink in this connection is to use a special punch for making revisions, or for indicating certain kinds of marks, the punch being ground to a square pyramid at the point. Triangular or other points may also be used if several different marks are desirable.—Edward M. Davis, Philadelphia, Pa.

To Prevent Machine Parts from Being Tarnished by Sulphur

A way to prevent brass machine parts from tarnishing when sulphur is used in the building is to paint them with naphtha or heavy oil. This can be removed with hot water and the brass polished with a dry cloth. This treatment is also good for the lighting fixtures in a home, while being fumigated, as it insures against damage by the acid fumes.—Loren Ward, Des Moines, Iowa.

Mechanics' Watch Charms

Any mechanic who likes to make things in his spare time, can turn his labor and ability into money by making and selling mechanics' watch charms. These charms are made in the shapes of the tools used by various trades. The material used is brass, which is easy to cut, quite strong enough for the purpose, and can readily be gold plated.



A Number of Gold-Plated Watch Charms in the Form of Tools Used by Various Trades

A little gold-plated monkey wrench always meets with admiration and interest. The frame is cut from one piece of brass, and the shank is turned or filed down and threaded at the end for a small nut. The handle is made from a piece of mother-of-pearl, cut down to the shape shown and drilled lengthwise to fit the shank. The sliding jaw is made by slitting a solid piece of brass, bending the lugs over the back of the frame, and soldering the ends together. The jaw is drilled and tapped for the adjusting screw, which is turned down and threaded to fit, a knurled head being formed on one end. The bolster slips over the shank to receive the tit of the screw. An eye for attaching the charm to the watch chain is soldered to the lower lug of the jaw. The parts are then gold plated, which will cover all traces of solder, and if well done, the plating will wear for many years.

A neat charm can also be made in the form of a carpenter's saw. The blade is nicked on its lower edge with a knurling tool, making tiny teeth that can be seen and felt. The handle is made of black or red fiber, and attached to the blade by means of small brass rivets.

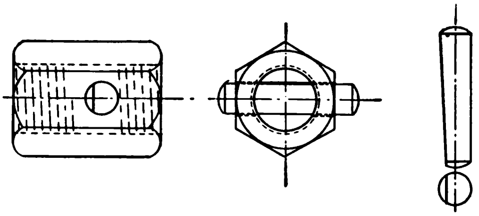
Hammers and hatchets of various kinds also make attractive charms. These tools should have wooden handles, made of ebony or hard redwood, and polished or waxed after they are cut to the proper size and shape. The attaching ring, in such cases, is made by twisting a length of gold wire into a groove cut around the handle.

A small gear and a micrometer have also been found very neat, especially the latter, when handsomely gold plated and engraved. The principal tools necessary for this work are a jeweler's saw, a jeweler's screwplate, and a set of taps to fit.

A Stud Driver

The driver consists of a piece of hexagon bar stock drilled and tapped to fit the threads cut on the stud, and a short pin having a flat surface filed tapering from one end to the other and fitted in a hole drilled through two parallel sides of the threaded piece.

In use, the driver is turned on the stud until the flat side of the pin strikes the top end of the stud. The pin is then tapped lightly with a hammer on the large end, causing it to tighten against the end of the stud. A socket wrench of the right size is used for turning it. To remove the driver from the stud, tap the small end of the pin lightly with a hammer and turn the driver in the reverse direction.—C. E. Bradley, Fall River, Mass.



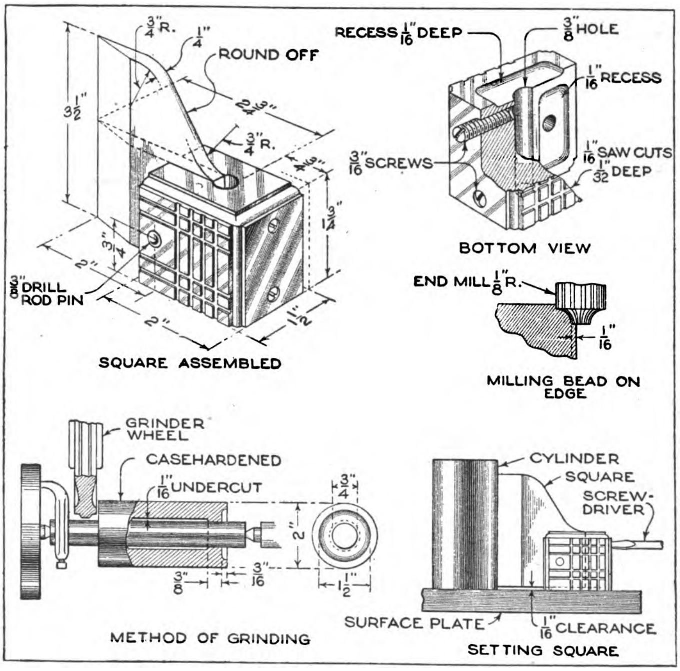
A Driver That Is Quickly Attached to a Stud for Turning It into Place

A Remedy for Heated Bearings

Prepare an oilcan by filling it with kerosene and flake graphite, about 1 part graphite to 7 parts of oil, and have it ready for any bearings that are likely to become heated. Force the mixture into the heated bearing until it flows out between the bearing surface and the shaft, then follow with a small quantity of thin machine oil.

A Toolmaker's Square and Test Block

A TOOLMAKER'S square, embodying a number of original features, is shown in the drawing. The square blade, of tool steel, is formed as illustrated, and finished to dimensions by grinding. The blade is supported in a steel block containing a slot into which the blade is inserted, and held by means of a pin passing through both members, so that the blade is, in effect, pivoted. The surfaces of the blade slot are recessed to make it easy to grind out the slot accurately; the recess is made with the side of a small end mill and is about 1/16 in. deep. Two holes are drilled through the center of the base, in line with the slot, and tapped to take the two adjusting screws by means of which the blade is lined up. It will be found necessary to drill a hole through the block at right angles to those drilled for the adjusting screws, in order to permit the tap to bottom. The blade should fit snugly in its slot without the least side play. The bottom of the base is recessed and the sides are checkered to provide an easy grip. The base can be finished by lapping with emery flour and oil to a high polish and the grooves in the sides can be filled with black enamel to accentuate the finish on the sides.



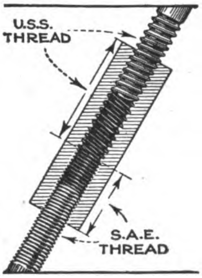
A Toolmaker's Square for Accurate Work Which Is Made So That It Can Be Checked and Adjusted by Means of an Accurately Ground Test Cylinder

The test cylinder is recessed at each end for 3/16 in., bored to fit the arbor used, and the bore is undercut for a part of its length, so that the hollow cylinder thus formed is supported on the arbor only at the ends. After being placed on an arbor and between centers of a lathe, the sides and ends are rough ground, the grinding wheel being dressed as in the drawing, so that the ends and sides can be ground at the same setting. After the rough-grind operation, the wheel is trued up again and the work is ground to its finished diameter. By grinding the cylinder in the manner described, it is evident that if it is exactly parallel throughout its length and the ends are ground at the same setting the block will stand squarely on the surface plate.

To line up the blade of the square, both it and the test cylinder are placed on a surface plate and the adjusting screws turned in or out as may be required until the edge of the blade is exactly parallel to the side of the cylinder. All parts should be made of tool steel, and casehardened.—Henry S. Laraby, New Haven, Conn.

A Novel Turnbuckle

Turnbuckles are usually tapped for a right and left-hand screw, but a good one can easily be made that is tapped for two right-hand screws, having different-size threads. About three-fifths of the body of the turnbuckle is tapped with a U. S. S.-thread tap; the rest with a S. A. E.-thread tap. Due to the greater pitch of the U. S. S. thread, when the body of the turnbuckle is turned, the screw with this thread travels nearly twice as fast as the other screw.



Clamp Holds Work Down on Top of Bench

This simple type of bench clamp, or holdfast, is constructed from stock that can be found around the shop. A ⅞-in. bolt has its head cut off and a slot cut in the body to take the clamping bar, which is made of ¾ by ⅜-in. stock. One end of the bar is bent around a small rod and riveted; the rod is then removed, and the hole tapped out for a ⅝-in. bolt. A long strip of ½ by 1½-in. bar stock, set into the bench and fastened with screws, has holes drilled and tapped at convenient intervals to receive the bench clamp. The long bar may also be placed underneath the bench top, so that screws will not be necessary to take the pull.

Bench Vise with Universal Base

Due to the limitations of the ordinary stationary vise, a workman must often stand in an uncomfortable posture in order to apply the file or other tool to the work properly. To overcome this difficulty, the vise illustrated has been devised and found very successful; it has a spherical base that can be adjusted to any position within an arc of 90°; this makes the vise especially adaptable for use in assembling small parts where individual fitting is necessary.

The constructional details and dimensions are clearly indicated in the drawing, but may be varied somewhat to suit individual tastes and requirements. The vise jaws slide in a T-guide that forms part of the body of the vise. A screw with right and left-hand threads, turned with a small socket wrench, moves the jaws. The jaws are, of course, made of steel, and are hardened and tempered.

The body, as well as the flange base and the plate underneath, is made of cast iron, although steel or brass will serve equally well. Machine bolts hold the flange base and the plate securely to the bench. A screw, provided with a ball-shaped head that seats in the body of the vise, and with a wingnut that can be loosened or tightened to permit adjustment, clamps the body when set. A setscrew in the side of the guide may be used to lock one jaw of the vise in position.

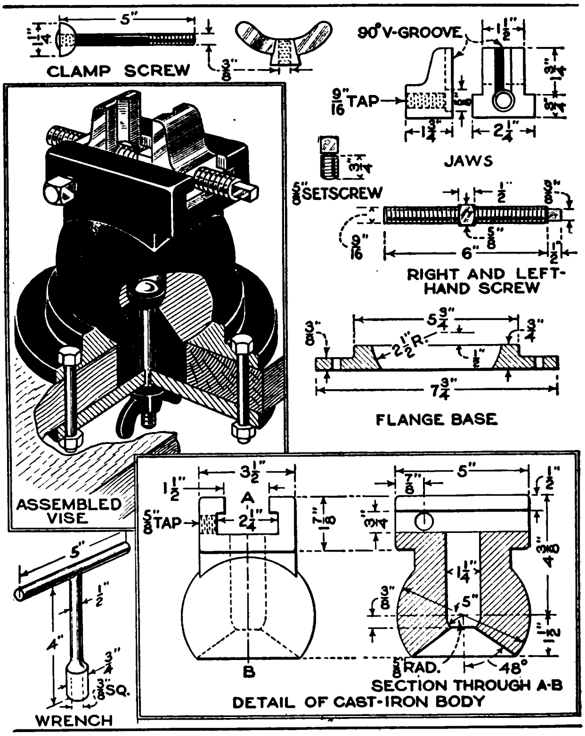
Making Loose Studs Hold

When a stud becomes loose in a cylinder head, it may be made to hold tightly by sawing two slots at right angles across the bottom of the stem the full length of the lower thread, and countersinking the intersection of the two cuts. A small steel ball is then dropped into the hole and the stud screwed home. The ball enters the countersink and expands the stud, making it grip tightly.

¶When putting up a line or jackshaft, be sure to make a liberal allowance for expansion and contraction.

Shop Apron with Convenient Spring Belt

Workmen in shops, as well as other persons who must wear an apron occasionally, are familiar with the nuisance of tying and untying apron strings, especially since they are easily broken in handling heavy objects. The use of an apron with a spring of band iron at the top instead of tie strings is quite convenient. The spring is curled slightly outward at the ends and may be slipped about the body quickly. It is not easily broken.



Bench Vise That Will Be Found Very Useful by Toolmakers and Machinists, as the Base Can Be Adjusted to Many Positions

Dressing and Cleaning Leather Belts

In service, a belt gradually loses a portion of its lubricating material, so that, unless this is renewed at suitable intervals, the durability of the belt is impaired. A good grease or dressing gives the belt sufficient flexibility, and at the same time causes it to cling to the pulley, but does not subsequently stiffen or injure it in any way. Among the best belt dressings are mixtures of cod and neat's-foot oils, with tallow, and wool grease free from mineral acid.

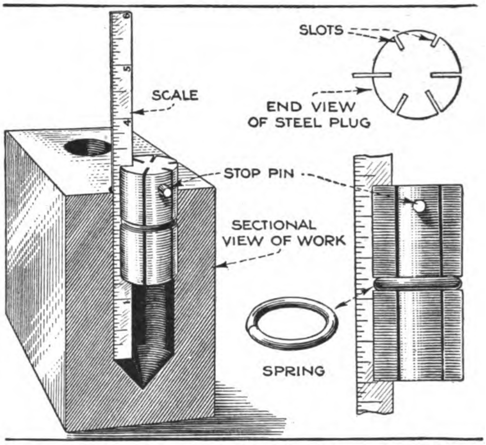
Clean the belt well, especially on the pulley side, by washing it with warm water and a good neutral soap, such as castile or white toilet soap, and, if necessary, scrape it on the pulley side to remove any dressing and dirt that may be caked there. Caking of dressings is injurious to the belt and also causes it to run unevenly. Wash rapidly and under no circumstances permit the belt to become wet, as it will then stretch and slip, and cemented joints may become loosened. Apply the dressing, which may be either liquid or solid at ordinary temperature, to the outside of the belt, while it is at rest, and allow it to soak overnight. It should be applied very evenly and rubbed in with cotton waste, felt, or similar material. If absolutely necessary, a very light dressing may be applied to the pulley side of the belt, using cotton waste or felt lightly coated with the dressing. Even distribution and penetration should be aimed at. Resin, or greases containing it, weaken the belt and shorten its period of service. The use of too much dressing causes undue stretching and loss of grip. Belts should never feel greasy or look greasier than when they were installed. Because a little belt dressing is good for belts, it does not follow that more is better; just as little as possible should be used, but enough to make the belt flexible, and cause it to cling to the pulleys.

Etching Steel

One disadvantage of using nitric acid for etching steel is that the gas given off "lifts" the wax or other ground, causing very ragged edges on the lettering, if not making it unreadable. Another is that the fumes will rust near-by tools. These faults are not found in an etching solution of copper sulphate and common salt, made with equal quantities of fully saturated strength, and the solution is just as satisfactory as the acid.

Depth Gauge for Drilled Holes

Measuring the depth of drilled holes is a somewhat uncertain operation, as the bottom is conical and dimensions are invariably given to the top of the cone. Most measuring devices used for this work tend to slip down into the conical end, and therefore one cannot be sure whether the holes have been correctly gauged or not. On the production of a machine part furnished with several holes of slightly different diameters, one shop uses the gauge shown in the photo.



Accurate Plug Depth Gauge for Measuring Drilled Holes

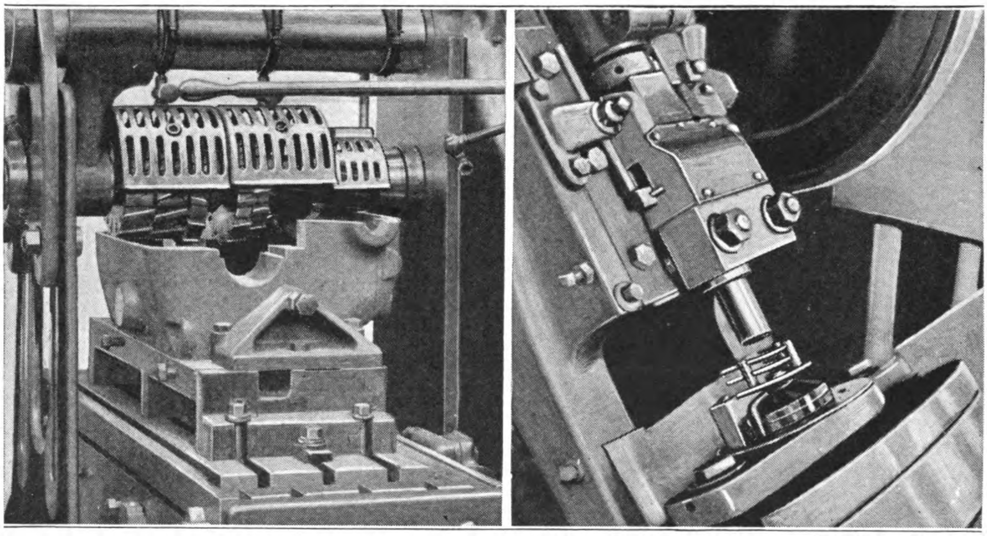
It consists of a round-steel plug with slots sawed in it lengthwise, the depth of these slots varying to suit the different hole diameters so that when the scale is inserted in the slot the plug and scale will fit the hole exactly, as shown. A groove is cut around the plug in the center and a single coil of spring wire slipped in it to hold the scale lightly in any of the slots. At a definite distance from the top a pin is driven through the plug to prevent it from falling into the hole. In use, the scale is slipped in the slot marked to suit the hole to be measured and the plug inserted into the hole until the pin rests on the top. The scale is then pushed down until it strikes the bottom and the reading of the scale taken from the top of the plug. Thus if the face of the pin is ½ in. below the top of the plug, the correct measurement will be ½ in. less than the depth to the top of the plug. With slots sawed in the plug to suit the different holes it fits snugly in each case, and the measurements are accurate.

¶Do not use a fine file on babbitt metal or lead.

Two Simple Machine Guards

Anything that protects the operator of a machine from injury without interfering with production is well worth while, and the photographs illustrate two such safety devices that have been found quite efficient.

The first picture shows how the cutters on a milling machine have been covered so that not only are chips prevented from flying into the operator's face, but the hands are kept from contact with the revolving cutters. The other picture shows a small wire guard which is so placed around the die of a punch press that the operator cannot possibly get his hand underneath, and, of course, he would never want to put it over the top. This particular type of guard saved so many fingers that it was installed on all the punch presses of the firm using it.



Left, Guard for a Milling Machine That Prevents Chips from Being Projected into the Operator's Face and Keeps His Hands from Contact with the Cutters; Right, a Safety Guard for Punch Presses That Prevents the Operator from Getting His Fingers under the Descending Ram

The Pocketknife as a Planimeter

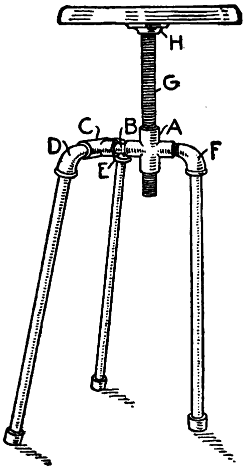
The planimeter, which is used by engineers and mechanics to measure irregular areas, is quite an expensive instrument. Few people are aware that almost the same results can be obtained with an ordinary two-bladed pocketknife. To measure an area with the knife, proceed as follows:

First, draw on paper a square of exactly 1 or 2-in. length of side, and open the large blade of the jackknife, which should be quite sharp for best results. The smaller blade is opened halfway, so as to be at right angles to the handle and large blade. The end of the small blade is then grasped between the thumb and forefinger of the right hand, and placed at the left-hand corner of the square, nearest the user. The rest of the knife should now be swung around like a compass on the point of the small blade as a center; the large blade will thus mark out an arc, distances along which are to represent areas. Make a pencil mark across this arc, for the starting point of the large blade. Place the point of the small blade again at its starting point, and set the large blade at the point on the arc. Trace with the point of the small blade around the edges of the square, thus outlining an area of exactly 1 or 4 sq. in., according to the size of the square, as it has been drawn. When the blade point has been brought back to the starting place, make a mark at the point on the arc where the large blade rests. The distance from this point to the first point on the arc represents 1 sq. in. of area, or 4 sq. in. if the 2-in. square is used, in which case the distance should be divided into four equal parts.

Having found in this way the distance along the arc to represent 1 sq. in., succeeding points, to mark off larger numbers of square inches, can be found by going around the square again and again. Then proceed to measure any irregular area of reasonable size, in the same way. Start at a corresponding point on the outline of this area, moving around it in the same direction. On arriving at the starting point, measure the distance on the arc, which the large blade has traveled, and compare it with the distance which has been found to represent 1 sq. in. This measures the irregular area in square inches. It is easy to construct on a card a scale which, when laid on the arc, will enable the operator to read directly the area in square inches. Such a scale will hold good for the same pocketknife, whenever the small blade is opened to exactly the same point as in the test, or calibration.

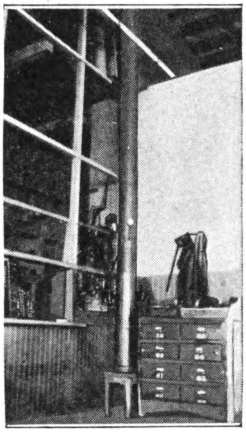
While absolutely accurate results are not to be expected with this instrument, it is surprising how closely the measurements will agree with those made by an expensive planimeter.—Frank L. Brittin, Chicago, Ill.

How to Make a Shop Stool



The central piece consists of a ⅜ by ½-in. reducing cross fitted on one end with a close nipple, B, which in turn is screwed into the side outlet of a ⅜-in. tee, C. Two ⅜-in street els, D and E, are screwed into the end openings of the tee, and one into the cross. Three pieces of ⅜-in. pipe are cut about 2 ft. long, and a thread cut on both ends of each piece. One end is fitted with a cap, and the other end turned into the street els D, E and F. This completes the three-legged base of the stool. The standard G of the seat is made of a piece of ½-in. pipe about 1 ft. long. A long thread is cut on this pipe so that it can be secured into the ½-in. threads of the cross A. The upper end of the standard is fitted with a floor flange, H. The seat is a wooden disk turned to about 8 in. in diameter. The floor flange H is fastened with screws to the underside of the disk. All joints should be turned up tightly; and to make a more rigid stool, drill holes and place rivets through the parts.—F. S. Moore, Los Angeles, Calif.

Oil-Well Casing as Air Tank



At a western oil company's shops, an oil-well casing, closed by welding at both top and bottom, serves as a compressed-air tank. The air is maintained at very great pressure in this shop, and the casing makes a safe receptacle for storing the air. Besides, being placed in a corner of the shop, it does not take up valuable room. It is supported on a wooden base about 1 ft. above the floor. The idea may be interesting to many small shops in the oil districts.—C. W. Geiger, San Francisco, Calif.

Easy Way to Shift Belts

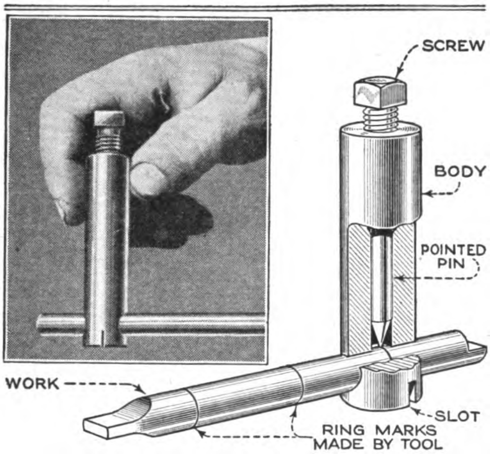
To obviate the tendency of the belts, where ordinary pulleys are used in group driving of machines, to slip over the flange of double pulleys and thus throw the equipment idle, the designing engineers of a big cotton-manufacturing plant at East Boston, Mass., devised a method which at the same time demonstrates the flexibility of the motor drive in special cases.

In this plant, the first floor of the spinning department contains forty 20-hp. motors driving 160 frames. A double pulley is installed on each end of each armature shaft, four frames being driven per motor, but instead of the usual flange on the double pulleys to separate the belts, the crowning on each section is made ¼ in. off center, away from the middle of the pulley. By this means the belts are kept apart without any danger of their climbing the flange and being thrown off, and in addition, by centering these tight and loose pulleys on the frames with the highest point of the crown on the driving pulley, the belt can be shifted without throwing it off the motor pulley.

¶It is well to remember that a slight blow will break out the arms or rim of an iron pulley if trying to move one when stuck on a shaft.

Circle-Marking Tool

The tool shown in the drawing and photograph was made for the purpose of scribing true lines around light rods, the lines being afterward used to locate the position of holes drilled partly through the rods. The body of the tool is round cold-rolled steel. A hole is drilled lengthwise in the center to take a pointed pin and the hole is tapped at the end for a screw. Another hole, the approximate size of the rods, is drilled at right angles to the first at one end, and a slot is cut in the end at right angles to the hole for the rods. In using the tool the position of the circle on the work is first determined and after marking this with a fine punch the tool is slipped on and located in line with this mark by bringing the mark in the center of the slot. The screw is then turned in until the hardened point of the pin touches the rod, when, by revolving the tool, a true line is marked around the rod.



An Easily Made Tool for Scribing Circles on Light Rods Accurately and Quickly

Care of Oil-Soaked Waste and Rags

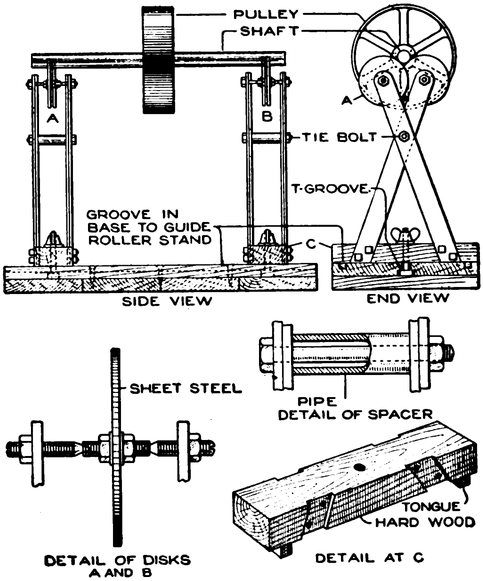
The danger of spontaneous combustion from rags or waste saturated with oil in shops, garages and residences is not sufficiently understood. This is, no doubt, because most people do not know that linseed oil will oxidize rapidly, and if cotton is soaked with oil, enough heat will be generated in a short time to char the cotton. The addition of red lead seems to make the heating more rapid, as pipe fitters have frequently observed.

It is a common thing for pipe fitters to clean the red lead and oil from a new joint by wiping it with a handful of waste. It is also common for the workman to carry the waste in his pocket. A pipe fitter once felt a hot spot against his body, which caused him to investigate his pocket with the result that he found a pocket lining burned out and a mass of charred waste. If this jacket had been hung in the clothes closet at home, a burned dwelling might have resulted, with the origin of the fire a mystery.

The safe thing to do is never to put oil-soaked rags away for safe keeping. Either burn or wash them at once. In mills, power stations, shops, garages, etc., where there is a quantity of oil-soaked waste, cans should be provided to receive the discarded waste. The cans should be made of heavy sheet metal with riveted seams, and with iron legs to hold them several inches from the floor. Use a tight-fitting metal cover.—F. W. Brady, Scranton, Pa.

Disk-Bearing Stand for Balancing Rotary Machine Parts

Balancing flywheels, pulleys, and similar parts, is simplified by the use of a disk-bearing stand, as illustrated. The disk-bearing surface allows the part to rotate with so little friction that the heavy portion to be trued immediately goes to the bottom. Material is then removed from the heavy side until an accurate balance is obtained. The disk rollers are carried

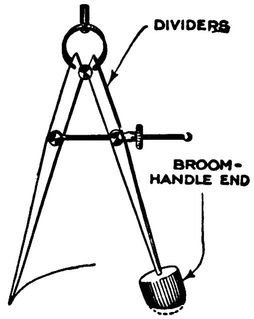


The Parts to Be Balanced Rotate without Friction, Sending the Heaviest Portion to the Bottom

on conical bearings, supported by a steel framework mounted on a base of well-seasoned hardwood. The distance between the disk rollers is adjustable for accommodation to various lengths of shafts.

A Ball Center for Dividers

When called upon to drill a series of holes equidistant from the center of variously sized pieces of thick sheet steel, each with a ⅝-in. hole in the center, the ball-end dividers shown in the drawing were improvised for accurately laying out the new holes a certain distance from the center hole. The rounded end of a broom handle was cut off, and one leg of the dividers was tightly inserted into the wood, thus forming a ball center. —W. S. Standiford, Youngstown, Ohio.

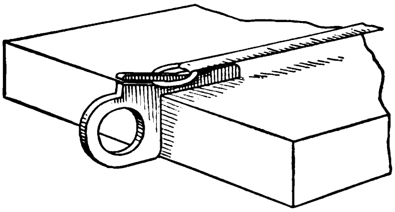


Coke as a Substitute for Sandpaper

A sandpaper substitute, that has special merit for removing rust from tools without scratching, is made from crushed coke. The coke is crushed to the required degree of fineness and sifted through a piece of cloth onto a piece of coarse paper which has been coated with glue. After the glue has dried, the paper is ready for use.

A Tapeline Holder

It is very difficult to measure with a tapeline alone, so I made a holder as shown in the sketch, which is placed on the end of a rail or whatever material being measured. This device also makes it easy for a helper to hold a line.—Le Roy Bradley, Lorain, Ohio.


The End of the Tapeline Measure Is Held Flush with the Material Being Measured

Lock and Chain Prevent Accidents

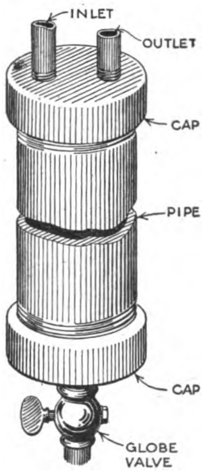
Deaths and accidents are often the direct result of a machine being set in motion by some one who does not know that there is a man working on it. Practically all such accidents can be prevented by providing the men who do work of this kind with a piece of chain and a padlock, and making the use of them compulsory, to lock the starting lever, switch, or whatever it is that makes the machine operative. In the same way, whenever it is necessary for a man to enter a boiler, gasometer, or similar vessel, he should lock all inlet-control valves, and take the key along with him to prevent the steam or gas from being turned on. Sprinkler-system valves, and other valves that are connected to the fire-protection system, which should be kept open, can also be kept from being closed by the application of a lock and chain.

Removing Moisture from Air Blast

Any person familiar with compressed air knows that water is always present, to a greater or less extent, in the air, and is a great nuisance, especially when the air is used to furnish blast for an oil or gas furnace.

The accompanying illustration shows a device that can be made from standard fittings, and connected on the line in series just ahead of the furnace. It will remove nearly all water without the use of any other trap. However, a common trap may be employed in addition, if desired.

Using a piece of pipe, four to six times the diameter of the supply line, and 1 to 2 ft. long, attach a pipe cap or a blank flange to each end; tap out two holes in the upper cap, as shown, for inlet and outlet, and provide a drain pipe with globe valve at the lower end.—W. H. Steele, Pittsburgh, Pa.

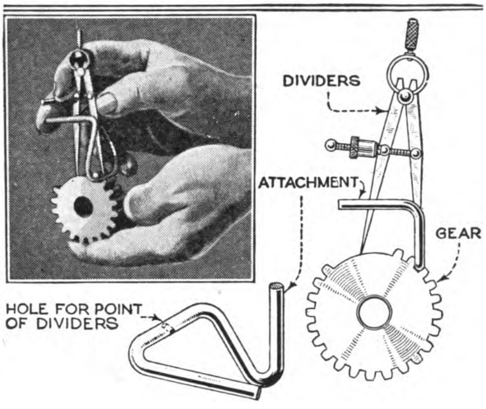


¶The contact points of a firm-joint caliper should never be struck on hard surfaces to adjust them.

Divider Attachment Marks Gears

The divider attachment is well worth including in a repairman's kit for its usefulness when "pegging" gears.

When several teeth of a gear have been sheared off it is, of course, important to place the inserted pegs in the same position as the broken teeth, and it is for the purpose of marking the correct position that the attachment shown in the photo is used. It is made from a length of drill rod, bent to the shape indicated and drilled for the point of the dividers. The attachment and dividers are then assembled, the cross leg of the attachment set between two of the gear teeth, and the free point adjusted to the center of any convenient tooth. It is not necessary to open the dividers enough to span the complete gap in the gear teeth; about half the distance will do, as the dividers are used from each side of the gap. After filing or grinding off the remnants of the broken teeth, the surface is blued and the attachment moved across the tooth with the free point of the dividers touching the blued surface. The same process is repeated in the next tooth space and so on until the position of each missing tooth has been marked.



Simple Attachment That Enables the Repairman to Space Pegs Correctly When Repairing Gears

It will be seen that the dividers are held securely at right angles to the axis of the gear, so that the lines marked will run straight across, besides preserving the correct pitch. If the lines are followed closely in drilling, it will be found that, no trouble will develop from "off-pitch" pegs.

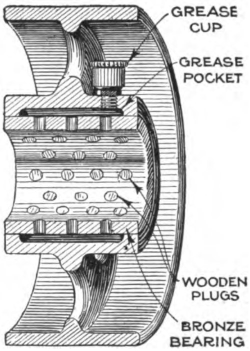
¶Any lost motion should be quickly taken up on the bearing of any machine.

Hand Drill as a Speed Counter

A short time ago a new electric motor was installed in a shop department. It soon became apparent to the foreman that the line shaft speed was much slower than it had been with the old motor. The electrician who installed it had no speed counter with him, but he picked up a hand drill which was on the bench, counted the teeth in the gear and pinion, and found that there were five times as many teeth in the large gear as in the pinion. He then put a twist drill in the chuck, and inserted the end of the drill in the center of the shaft. With his watch in his left hand, and the handle of the drill in the right, in such a position that the handle on the gear would just touch his hand at every revolution, he counted the revolutions made by the handle in a minute. Multiplying this by five gave him the number of revolutions made by the shaft drill, this being therefore the speed of the shaft.

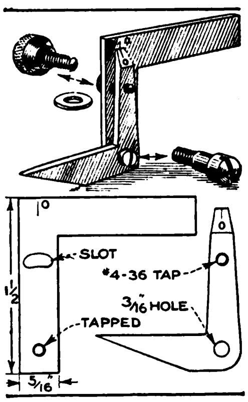
Oiling Loose Pulleys

Inadequate lubrication of loose pulleys causes excessive wear on countershafts and necessitates frequent rebushing of the pulleys, and to keep the ordinary loose pulley well lubricated requires considerable more attention than can be given it in the average shop where no oiler is employed. The drawing shows a method of lubricating that has been adopted by a large shop. The pulleys are bored for an oversize bushing, and recessed to form a grease pocket around the hub. Bronze bearing metal is used for the bushings, which are pressed into the hub. Before taking the finishing cut on the bushings, ⅛-in. holes are drilled in them, as shown, and plugged by driving in hard-maple pins; the finishing cut turns these flush with the bearing surface. After placing the pulley on the shaft, the annular pocket is filled with a good grade of light grease. The pulleys are well oiled when first placed on the shafts; afterward the grease works down through the plugs and good lubrication is insured.—Lowell R. Butcher.



Auxiliary Finger for Height Gauge

In selecting lines on jigs from which to locate other lines, more or less trouble is encountered by not being able to get an exact measurement, owing to the stiffness of the height gauge. I therefore made the scriber shown in the illustration, which gives very good results. It is made in two parts, connected by means of a small screw. To set the scriber, the thumbscrew is released so that the pointed end can work freely. The sharp point is inserted into the line and the head of the gauge raised or lowered until the two zero lines meet; the thumbscrew is then tightened, leaving the scriber parallel and the center of the line located correctly. The remaining measurements are taken from the graduations on the height gauge. The drawing gives the dimensions and shows how the tool is assembled.—Fred A. Dufrense, Riverside, Rhode Island.



Drawers Made from Varnish Cans

Ordinary varnish cans of 1 or 1½-gal. size can be turned into very serviceable and durable drawers for holding small tools, nails, screws, putty, and, if desired, liquids. One side of the can is cut away. The sharp edges remaining are bent or hammered down so that there will be no danger of cutting the hands. A number of slides on which the cans may run easily can be arranged underneath the workbench, or if desired, a special frame can be built to contain them, making a neat storage cabinet.—Harry W. Poor, Boston, Massachusetts.

How to Find a Crack in Metal

Clean the surface of the metal, turn on a small quantity of kerosene and allow it to stand for a minute or two, then wipe off the oil and strike the piece a sharp blow with a hammer. The oil will show along the outline of the crack. The jar caused by the blow of the hammer will drive the oil out of the crack to the surface of the metal.—J. F. R., Bethel, Vt.

Hints on Babbitting

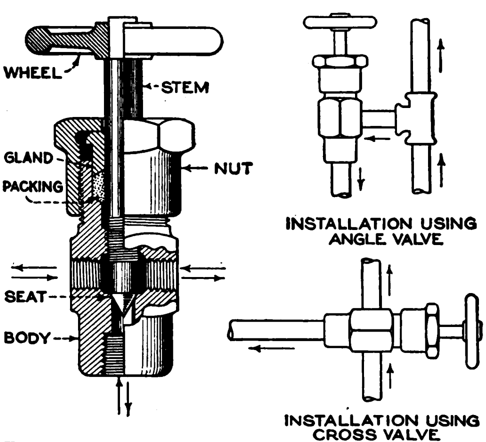
Babbitt is ready to pour when it will ignite a light pine stick—a greater heat injures the babbitt. Always provide means of escape for the air. The air must go out before the babbitt enters. If possible, heat the casting to receive the babbitt. This not only saves chilling the molten metal, but it lessens the relative contractions of the casting and the babbitt, making the latter a closer fit. Small castings can be heated in a fire and large ones heated with a blowtorch.

Always provide a liberal head for the mold to draw from, especially on large jobs. Unless this is done, a shrink hole is almost sure to form at the top.

The best way to remove old babbitt is to put the box in a fire and melt it out. When this is done the box should not be put in water to cool. Water should never touch any parts being babbitted. This is the first rule to observe for personal safety, and the second is to wear goggles to protect the eyes.

Making and Using Cross Valves

A much neater and stronger pipe job can be done by using a cross valve than by using an ordinary angle valve, because the tee and nipple, which must be used with the latter, are eliminated. A cross valve can readily be made by drilling and tapping the side of an all-steel needle-point angle valve, as indicated in the sectional view to the left in the illustration. The run of the valve is used in the main feed line, and when the valve is closed, the liquid flows in only one direction.

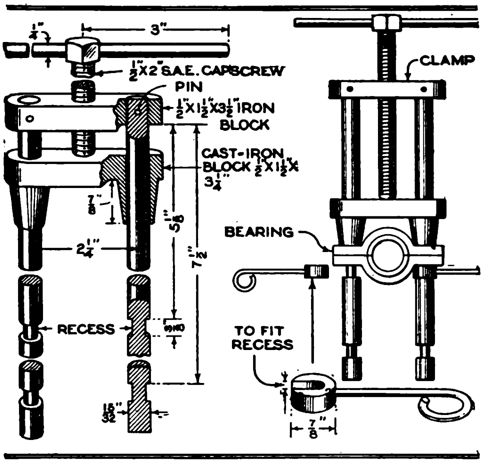


WHEEL
STEM
GLAND
PACKING
NUT
SEAT
BODY
INSTALLATION USING ANGLE VALVE
INSTALLATION USING CROSS VALVE

Left: An All-Steel Angle Valve for Use as a Cross Valve. Right: Comparative Installations

Clamp Aids in Fitting Bearings

In all the larger repair or service shops for the most popular make of light automobiles, the bearings of the engine are "burnt in," or fitted with a machine. As these burning machines are quite expensive, the small shop must still use the time-honored method of hand scraping. After the babbitt in the cylinder block and in the bearing cap has been scraped to an approximate fit, the cap is bolted down and the crankshaft revolved. Often the cap bolts must be loosened and tightened several times before a correct fit is obtained or the proper number of shims inserted.



A Fixture for the Automobile-Repair Shop That Cuts Down the Time of Fitting the Main Engine Bearings of Light Automobiles

By using the tool shown in the drawing, about two-thirds of the time used in fitting the shims can be saved. The two pieces of steel rod, each 9 in. long, are turned and assembled with the other parts, the form and dimensions of which are shown. Two washers are made from tool steel, slotted to fit neatly into the recesses on the rods, a handle is screwed into each, and the washers are then hardened.

To use, place the bearing cap in position, with the estimated correct number of shims under it, place the cast-iron block upon the cap so that the holes coincide, and slip the rods through the holes. If in the first, or center, bearing, the recess near the upper end will extend beyond the upper end of the hole about ⅛ in. If in the rear bearing, the recess near the middle of the rods will be the one to use. Slip the slotted washers into the recesses in the rods, tighten the capscrew, and try the shaft. If it needs more or less shims, loosen the setscrew, pull out the slotted washers and lift off the cap. Repeat the operation until the shaft is just right, then insert the proper bolts, tighten the nuts and insert cotter pins.—Vernon Orr, Pomona, Calif.

Forcing Oil into a Bearing

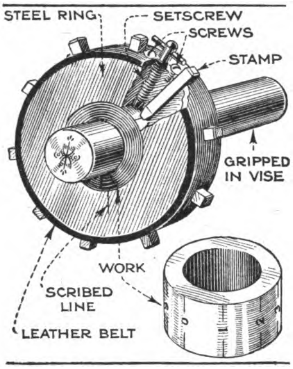
Sometimes when a bearing becomes heated and requires oil it will be found that the oil will not flow down in the oil hole. Either the hole is clogged with dirt or the heat may cause the air to rise and prevent the oil from entering. Where a wire cannot be used effectively, the following remedy, although it is not infallible, is almost sure to make the oil reach the bearing. Fill the hole with oil and quickly place the thumb over it to prevent the air from escaping, and if the oil cup does not leak, the heated air inside will rise above the oil, and in two or three minutes it will be forced into the bearing, even if it has to pass considerable dirt. When a bearing cannot be reached in this way, and when light oils, such as kerosene, are ineffective, try placing a little mercury in the oil hole and allow it to remain a few minutes, then use oil.—J. B. Murphy, Plainfield, N. J.

Signs on Idle Machinery Give Reasons for Delay in Production

Where there are a large number of machines in a department it is not an easy matter for the foreman to keep in mind the exact reason why any one machine is idle. An idle machine means a decrease in production and a consequent lowering of efficiency of that department. A factory has adopted the method indicated by the drawing, of placarding all machines, whenever shut down, with the reason for the delay in production. The signs are of metal, 8 in. long and 4 in. wide. If the material has been used up a "Stock" sign is placed on the machine. Other signs read, "Repairs," "Tools," "Operator," or as the circumstances may be. The superintendent, walking through the department, notes the signs and immediately takes the necessary action to put the machine bearing such a sign in operation.

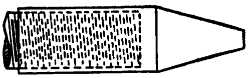
Stamping Graduated Collars

In a small shop having a number of graduated collars to stamp from 0 to 9, it was found that the usual method of stamping each number separately was too slow, and that a quicker method would have to be adopted to make the operation profitable. A fixture that was found to facilitate the work considerably is shown in the illustration. It consists of a steel ring that fits over the collars, having ten holes drilled through from the outside, these being equal in diameter to the corner-to-corner dimensions of the stamps. To hold the stamps squarely in the holes and to prevent them from falling out, the ring is covered with a piece of 1-in. belt, fastened with a couple of screws, and square holes are cut in the belt to fit tightly over the stamps. A hole is drilled and tapped for a tightening screw with which the fixture is tightened on the collar. After the collar is slipped on a short length of steel rod, which is held in the vise, the ring is turned so that the numerals on the stamps are brought in line with a mark already scribed on the collar and they are then impressed by tapping lightly with a hammer.



Protecting Bolt Threads While Passing through Cored Holes

Machines not requiring accurate work usually have cored bolt holes. If more than two pieces are to be fastened with bolts it is difficult to enter a bolt without injury to the threads. Where there is a ½-in. clearance this can be readily remedied by making a point for the bolt, as shown in the sketch. The one illustrated was for a 2½-in. bolt entering a hole 3 in. in diameter through two stands and a machine base. In this instance it was difficult to get the three pieces so that the holes would line up accurately. The point protected the threads, also made it easy to drive the bolts into place.—Fred W. Fravel.

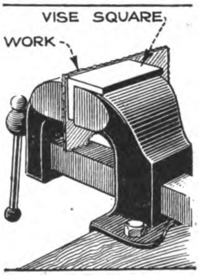


Silent-Chain Sprockets as Belt Pulleys

Small electrical generators for automobile use are almost invariably driven by silent chains running over sprockets. A fact not very generally known is that such a sprocket can be used without alteration to carry a belt when necessary for testing the generator, or even for regular operation on a car in emergency. Many mechanics would suppose that a flat belt would not stay on the sprocket, since it is not crowned like a belt pulley. A test will convince, however, that there is no danger of the belt coming off unless it slips or breaks. The greatest objection to running a belt on a silent-chain sprocket is that it is very hard on the belt and its coupling. The drive should therefore never be used except for a test or when a broken chain, which cannot be immediately replaced, makes the use of the belt necessary.—Curtis Ralston, Chicago, Ill.

Square for Filing Templates

When filing templates having several straight edges in the vise, considerable time can be saved and eye strain prevented by using a vise square of the type shown in the drawing. It should be made of tool steel, hardened and ground, and should be just as long as the width of the vise jaw. After the template has been roughly cut down to the desired size, about 1/32 in. outside of the lines, it is ready for filing and is clamped in the vise as shown, matching the line with the edge of the square. The latter prevents the workman from filing the template down too far. —Chas. Homewood, Ontario, Calif.

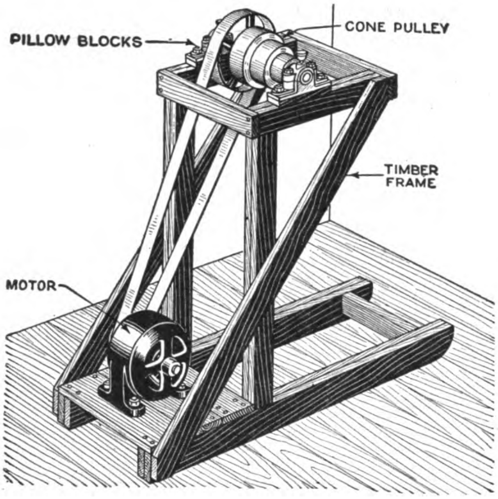


Cementing Leather to Iron

To cement leather to an iron surface, paint the iron with a mixture of white lead and lampblack in oil. Then cover with a cement made of the best glue soaked in water until soft, and dissolved in vinegar. This is thoroughly mixed with one-third of its bulk of white-pine turpentine, and thinned with vinegar until it can be spread with a brush. The cement should be applied to the iron hot and the leather put on and quickly pressed into place; the parts should be held tightly in a clamp while drying.

A Portable Countershaft

The drawing shows a portable countershaft that can be used to advantage under many conditions. A heavy timber frame was made, and an electric motor was attached to the bottom platform; at the top of the frame, two pillow blocks were placed, to support a shaft and cone pulley, from which a belt ran to the motor. With such an arrangement, it is a comparatively simple matter to transport it to any part of the factory, to take the place of the regular motor that is out of commission, or for temporarily driving a single machine.—J. H. Moore, Toronto, Ontario



A Portable Countershaft for Emergency Purposes, That Can Be Transported to Various Parts of a Factory with Comparative Ease, Is a Time and Money Saver

How to Cool Hot Bearings

Newly babbitted bearings are sometimes inclined to run hot. In a case of this kind, after scraping the box well to make the shaft fit closely in the box, use some good light oil mixed with common sulphur. Sulphur contains just enough grit to grind the babbitt smooth, but will not injure the shaft. Other material having a grit should not be used as it is liable to grind a shoulder on the shaft.

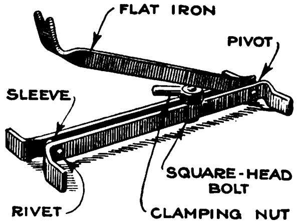
Should the bearing run hot after using the sulphur and oil, then use white lead and water—a very cooling mixture. Keep the shaft running and pour white lead and water into the bearing until it finally cools. Never shut down the machine while the bearing is hot, as the babbitt will contract and stick the shaft.—Harry Fritzinger.

Remedy for Overheating of Bearings

Persistent overheating of bearings which are in constant duty may be overcome by applying a mixture of flour of sulphur and lubricating oil to a consistency permitting use in an oil cup. This mixture will also be found useful on heavy-duty bearings in cam rolls, and similar machine parts.

Adjustable Stock Support

For a small shop, the handy stock support illustrated will be found much more useful than the usual telescopic arrangement, since it can be used to support bars very close to the floor, as in fitting a shaft to the finished machine, or high up for pipe-threading machines and work in the vise. It is made of ¾ by 1½-in. flat stock. Two pieces of stock form the base. These should first of all be dropped at the ends enough to clear a bolt head, then bent at right angles to form feet. The lever support is twisted at right angles at one end, bent upward a little, and a "V" cut. The opposite end is drilled for the pin on which it pivots, and which, being riveted at both ends, binds the three pieces together; a similar pin, with a sleeve, is used at the other end. An ordinary square-headed ¾-in. bolt slides between the two members forming the base, the top of the square on the bolt being filed a little on the sides to allow it to enter the channel and prevent it from turning. A special clamping nut is shown, which, of course, is convenient, but an ordinary nut will serve the purpose if the cost is to be considered. Made to a length of about 3 ft., this support has a range from that height to 6 in. from the floor. The bars held in this support must be fed or pulled forward so that the pressure is kept on the bolt, that is, away from the pivot.



Improvised Polishing Wheel

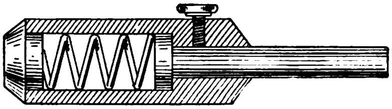
A simple and effective polishing wheel can be made by mounting a wooden disk on the shaft of a small motor, or on the screw chuck of a lathe, and covering the circumference of the disk with ordinary friction tape, which is then sprinkled with carborundum powder of suitable fineness. The disk must be turned down to a true edge and the tape must be wound in the direction that the wheel revolves, otherwise it will unwind in use. The carborundum powder should be well rubbed and patted into the tape, and, as it is quite easily torn from the tape by polishing, it must be renewed frequently. For the finest grades of powder it is well to rub the surface of the tape with tallow, before applying the powder.

Shock Produces Greater Strain than Pressure

Why does a hammer blow start a "stuck" shaft when a screw pressure will not? Assuming, for example, that the pressure applied is 1,000 lb. in each case. It is a law in mechanics, known and observed by all machine designers, that a force suddenly applied produces twice the stress of one gradually applied. A blow is twice as powerful as a static pressure. In designing machine parts this must always be kept in mind, for a part built to carry a ton weight would fail under a ton blow from a power hammer.

Caliper-Setting Tool

The device shown in the sketch has been designed and used for setting calipers accurately. It is placed between the micrometer anvil and head, the micrometer then being adjusted to the size required, and a small thumbscrew tightened. The spring inside is just strong enough to bring the plunger back in place.



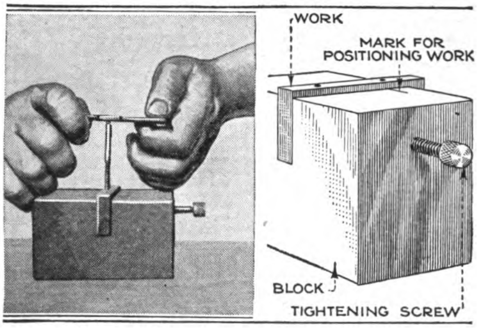
Tool to Set Calipers

Worn Loose Pulleys Replaced by Adjoining Set Pulleys

Much noise was caused in a small machine and pattern shop by the pounding of loose pulleys on the countershaft, the bore in the hubs being worn slightly oval. The set pulleys were removed and put in place of the worn loose pulleys. The latter were then set on the shafts in place of the old set pulleys. The noise and undue wear on the shafting was thus overcome.—J. C. Hansen, Chicago, Ill.

Preventing Tap Breakage

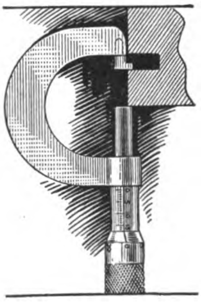
It often happens that a small tap suddenly breaks after it has been used constantly on the same kind of work. The breakage is most likely due to too much torsional strain. Breakage of taps due to this cause can be eliminated by providing a loose block to hold the work; then if the tap binds in the work, the whole block will turn. The block is simply a piece of cast iron with a groove or slot cut in it to hold the work and a tightening screw to hold it securely. The block is placed on the bench plate and the friction between the block and the plate is sufficient to hold the former stationary while the tapping is being done. By moving the work so that the hole to be tapped is eccentric, the block can be adjusted to turn before the tap gets too great a strain. When this position is found a mark is scribed on the block so that the work can readily be placed in the correct position.



Left, Using Loose Block to Tap Small Work; Right, Details of Block

Adding to Usefulness of Micrometer

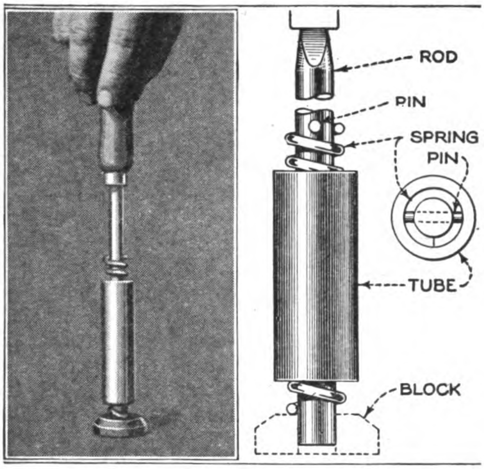
It is often necessary to take micrometer readings on work of the kind shown in the illustration. This is made possible by grinding down the head and part of the anvil about 1/32 in. as shown, leaving a 1/32-in. lip projecting. This will not affect the accuracy of the micrometer and will add considerably to its usefulness.—F. J. Haas.



¶Emery powder may be kept handily in an old salt shaker.

Flattening the Ends of Coil Springs

The illustration shows a handy tool for flattening the ends of coil springs, and one that can be made in a few moments to suit any size spring. It consists of two parts; a length of round-steel rod to fit the inside diameter of the spring, and a piece of pipe or tube to fit the outside diameter. The rod is driven into a wooden handle and drilled for a pin, as shown. The tube, which is only half the length of the rod, is used to cover the spring except the last coil, which is to be held over a gas flame, the tube protecting the rest of the spring from the heat. The spring is held in the flame long enough to anneal the exposed part, and then, while this end is hot, the end of the rod is slipped into a hole drilled in any convenient metal block and the handle pressed down quickly. The coils, will, of course, close for a certain distance before the end is pressed back and the tube will slide back over the pin as the tool advances into the hole. This method of flattening the end is particularly effective in case of brass springs.



An Effective Tool for Flattening the Ends of Coil Springs Can Be Made from Scrap Stock

Banking Material for Pouring Babbitt

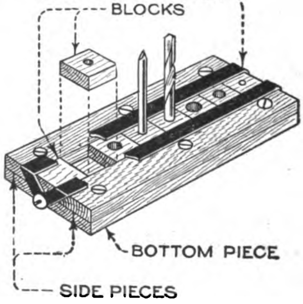
When pouring babbitt into bearings, or lead into cable fastenings, it is necessary to bank up the openings in order to confine the molten metal where it is desired. The most common material for the bank is wet clay, which can be molded into the required shape to fit the openings. A better method is to mix asbestos wool with heavy engine oil. This preparation not only serves the purpose better, but is practically indestructible. It is always ready for use, while the clay must be wetted and worked to the proper degree of plasticity each time it is used.

Easy Method of Removing Foreign Particles from the Eye

The removal of foreign substances from the eye is difficult when the hands are smeared with grease or other stains of shop work. Under such circumstances the desired result is frequently accomplished by immersing the eye in a basin of clean, warm water and then blinking rapidly half a dozen times. Unless the particle has actually been imbedded in the eyeball or lids this procedure will usually wash it out or into the corner of the eye, where its removal becomes easy.—T. J. Grogan, Atlanta, Ga.

Tool Stand with Movable Holes

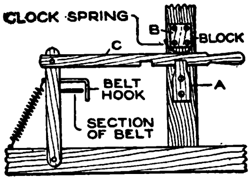
A tool stand of the kind shown in the drawing is especially useful around a drill press doing repetition work. It holds all the tools required on a job in a convenient manner and in the order in which they are used. Commonly a flat piece of wood is used for this purpose with a row of holes of various sizes, drilled to hold the tools, but this is in most cases rather clumsy because the holes being fixed cannot be adapted to suit the requirements of different jobs. The adjustable stand illustrated is made of wood and a piece of sheet metal. Two side pieces of wood are fastened with screws to a bottom piece, and a number of square blocks, drilled in the center with different-sized holes, are fitted between the side pieces. The blocks, when in place, are equal to the length of the stand, and are held in place by the sheet-metal cover, which is fastened to the wood by screws at each end.



Noseglasses can be held firmly to the nose by the use of powdered rosin. This is flesh colored and the heat will make the glasses stick so no ordinary wind will dislodge them.

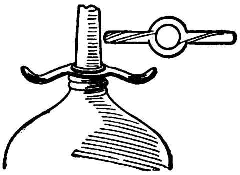
Simple Belt Shifter with Spring Lock

An ordinary belt shifter can be provided with a locking device, to prevent the belt from working back on the loose pulley and stopping the machine, by fitting the shifter with the arrangement shown. The method can be applied to shifters in various positions. The original shift lever is shown with the belt hook attached to it. The handle C is pivoted, with a screw, on the old shifter. An upright is fitted with a block, B, and a key, A. The key fits into notches, about 1 in. wide and ½ in. deep, cut at points slightly farther apart than the width of the belt. A section of clock spring on block B holds the handle against the key A. A spiral spring aids in keeping the belt hook in position over the loose pulley when the lock is not being used, temporarily. The shifting of the belt, and locking it securely is easily accomplished.—Robert B. Binns, Boston, Massachusetts.



Finger Rest for an Oilcan

In places where an oilcan is used very frequently, and especially where it may be covered with oil, making it hard to hold, a finger rest can be provided which will serve several purposes. A thin double-winged washer is made and provided with a hole, giving it a tight fit when slipped over the spout to the threaded end. It can then be soldered in place, and the projecting ends bent to conform closely to the finger positions when using the can. This attachment not only prevents slipping of the can when covered with oil or grease, but also provides a good grip for unscrewing the spout.—J. J. Kolar.

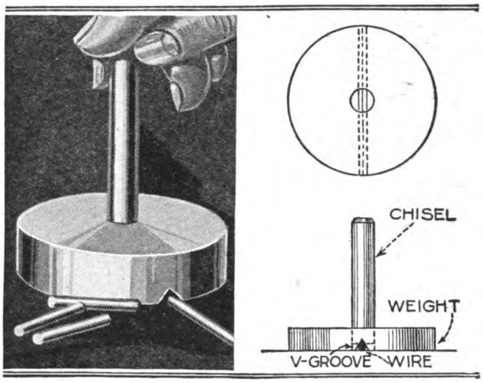


Storing and Running Rawhide Gears

Rawhide gears, when not in use, should be kept covered with shellac or hard grease, and should be stored in a place which is kept at a moderate temperature, in order to keep them from splitting or warping. In running such gears, do not use mineral oils, but lubricate with a mixture of light grease and graphite.

Cutting Wire Safely

Above a certain diameter, steel wire cannot be cut conveniently with ordinary pliers, and therefore a chisel is often used for the purpose. This method is rather dangerous, however, as the small pieces are likely to fly into the worker's face, and it is also somewhat inconvenient, as the pieces are apt to be lost. A better method of cutting the wire is to use a flat block of steel as shown, with a V-groove cut across the bottom, and a hole drilled through the center for a round-shank chisel. The wire is pushed along the groove and is cut off with the chisel.

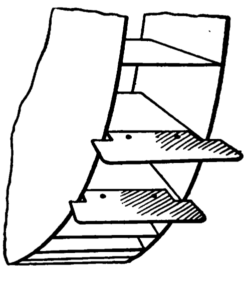


Left, Cutting Heavy Wire; Right, Details of Cutting Fixture

To cut the wire in equal lengths, it is either nicked with a file at the points to be cut and the wire then pushed along until the nick comes directly in the center of the hole, or a weight is placed on the block and a stop is provided on one side so that the wire can be pushed up against this and then cut off. Spring wire can be cut safely in this way.

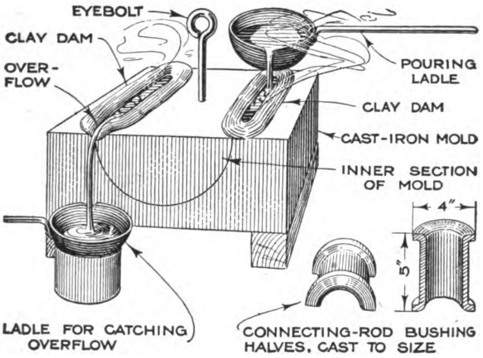
Increasing the Efficiency of a Blower

The blower of a cupola was not large enough to keep the blast at the right pressure and increased speed would not give the required results. The difficulty was overcome by adding small pieces of sheet metal to the fan in the space between the housing and the blades. An increased pressure sufficient for the furnace was obtained.



How to Pour Good Babbitt Bearings

Babbitt bearings which are full and up to size, and with a finish as good as die castings, can be poured by anyone in a metal mold, if certain precautions are taken. Have two openings to the mold, as far away from each other as possible; one opening is the pouring gate and should be surrounded with a clay dam, about ½ in. deep. The other opening is the overflow, around which a similar dam is built, but a small groove is pressed into the clay on one side, to allow the overflowing metal to run off into a ladle underneath, as shown in the drawing. The idea back of this is, that as the metal, which should be just hot enough to char a white-pine stick, heats up the mold to almost the temperature of the metal itself, all grease and dirt, which would cause trouble and produce gas bubbles, are washed away. Only one precaution must be taken, and that is to have the bottom of the groove in the dam around the overflow opening about ⅛ in. higher than the top of the mold; this is to allow for the contraction of the metal as it cools. When the mold is full, stop pouring, but do not remove the ladle until it is seen that the metal does not shrink below the top of the mold; if this happens, pour in a little more metal.—Joe V. Romig, Allentown, Pa.

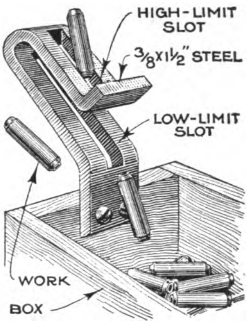


Babbitt Bearings, Full and Up to Size, and with a Finish Equal to Die Castings, Can Be Poured in Metal Molds by Taking a Few Simple Precautions

Work Gauged Automatically

The gauge shown in the drawing will be found applicable to many classes of work and will save the time necessarily required for a separate gauging operation; in addition, it prevents the machine hand from turning out work that is afterward found to be incorrect.

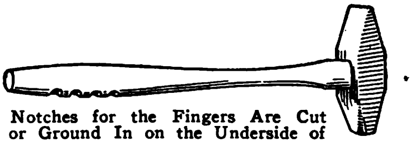
The work shown is a sleeve with beveled ends, the outer diameter being held within limits of plus or minus .01 in. The gauge is made of ⅜-in. flat steel, the first operation being to bend it into the form shown, the angle being about 45°. The slots are next milled, the high limit or "go" slot being milled so that the ends, when the gauge is fixed in place, stand in a vertical position, to prevent the work from falling through, back end first, and probably sticking. The low limit or "not go" slot is milled in the bottom portion. It may be as well to say that in cutting the slots, the gauge should be strapped on the table, on its side, and both slots milled with an end mill. The same method is used in grinding the slots to the finished size.



Two holes, drilled and countersunk, accommodate screws that hold the gauge to a wooden box. As the operator cuts off the pieces in a screw machine, he catches them in one hand and places them in the top of the gauge. If the work is below the high-limit size it drops through the slot, and if above the low limit, slides down the slot into the box. If above the high limit, the piece will not drop through the first slot, while if below the low limit, it drops through that slot and onto a piece of tin, where it immediately attracts the operator's attention.

Grip on a Hammer Handle

Before using a new hammer I have always found it to advantage to cut one or two inches off the end of the handle and then round it well to keep the wood from splitting. If the hammer is to be used on greasy work, it is a good plan to grind a groove 1/16 in. deep for each finger on the underside of the handle. This will make a grip for holding the hammer firmly.—J. H. Maysilles, Rochelle, Ill.



Notches for the Fingers Are Cut or Ground In on the Underside of the Handle

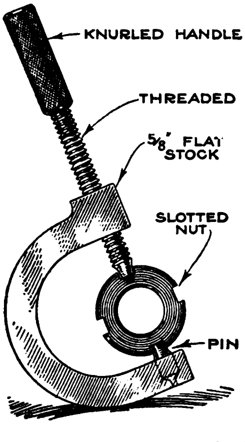
Making a Reamer Cut Oversize

When a smooth round hole of small diameter is required, a hand reamer is used to produce it, and many times the reamer is from .001 to .004 in. undersize. The reamer may be made to cut oversize in the following manner: With a scraper made of a medium-size half-round file, burnish the face of each flute, using the oval side of the scraper. This will raise a burr and cause the reamer to make the hole larger by an amount depending upon how hard the faces were burnished. It does not make a permanent edge, but serves very well in an emergency.

Adjustable Spanner Wrench

Every shop has some machines or tools fitted with slotted nuts, and it usually happens that one of the hardest things to find is a spanner wrench to fit a particular nut.

An adjustable spanner that will accommodate itself to nuts of different sizes can be easily made, and when it is remembered that these nuts are quite generally abused with a hammer and chisel when no wrench is at hand, such a tool is well worth making. The body, it will be seen, is similar in appearance to the frame of a micrometer caliper. One end is drilled and tapped to take a screw, which is turned from a piece of ⅝-in. cold-rolled steel. A pin, driven in the opposite end of the tool, is turned to the form illustrated. The tapered points of the plug and screw are casehardened.

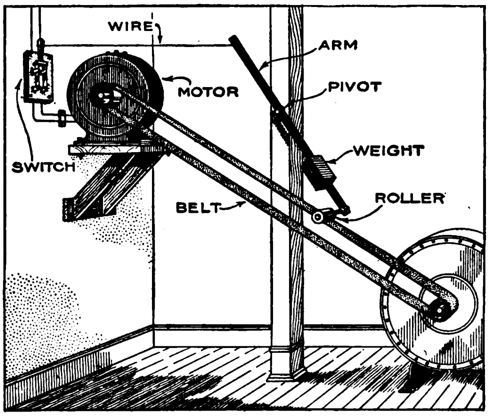


Hanging Oilcan Handy for Overhead Work

When oiling machinery that can be reached only by standing on a ladder, it will be found more convenient to hang up the oilcan than to set it down where it is in danger of tipping over. It is only necessary to solder a brass ring to the oilcan stem near its end. The ring can then be hung over a hook on the ladder, or on the machinery.

Circuit Breaker Stops Motor When Belt Breaks

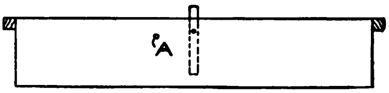
A simple arrangement for stopping an electric motor, in the absence of a circuit breaker, when the belt breaks or slips off the pulley, is shown in the drawing. A pivoted arm, having a roller and weight at its lower end, is connected to the switch, as shown, by a wire. Normally, the roller rides on the surface of the belt, but, should the belt break or slip off, the weighted end of the arm will drop to a vertical position and open the circuit.—Roy H. Poston, St. Francois, Mo.



As Soon as the Belt Breaks or Slips from the Pulley the Weighted Arm Drops to a Vertical Position, Opening the Circuit and Stopping the Motor

Lock for a Bench Drawer

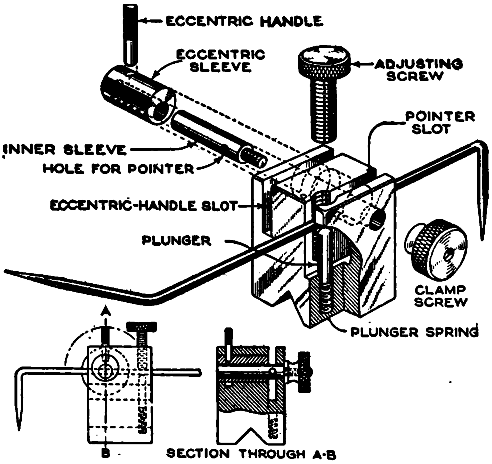
The bench drawer can be easily supplied with a lock that will answer the purpose and protect the workman's tools from the borrowing mechanic. The lock consists of a piece of ⅛-in. flat steel that will fit loosely in a vertical position in the drawer. About one-third of the way from one end drill a hole in the piece and fasten it with a nail or screw on the inside surface of the front part of the drawer. Another screw, A, is turned in where it will catch the longer end of the metal, and when the latch is turned over on this screw it will be out of the way. A scale or piece of flat steel inserted between the bench top and drawer will turn the latch so that the drawer can be pulled out.



The Lock Consists of a Strip of Metal Attached to the Inside of the Drawer Front

A Small Surface Gauge

In laying out small work on the surface plate, a block-type surface gauge is a convenient addition to the toolmaker's kit. The drawing shows a gauge of this type made from a piece of cold-rolled steel, 1 by 1 by 1½ in. The block rests directly on the surface plate, the conventional spindle not being used. Two slots, one for the scriber and one for the eccentric handle, are milled in the top of the block; a hole is drilled and reamed for the spring and plunger, and the upper portion tapped for the adjusting screw. A large hole is drilled partly through the block, and continued eccentrically with a smaller hole. The scriber is held in a sleeve, which is a working fit in the eccentric sleeve, and is clamped against the wall of the scriber slot when set. After being clamped lightly, the scriber may be closely adjusted longitudinally by means of the eccentric, and vertically by the adjusting screw, being then clamped firmly. The bearing surfaces of the block should be accurately finished, and the working fit of the sleeves as good as can be made. The block should be case-hardened and ground if possible.



A Cheap but Efficient Surface Gauge, Which Will Prove Handy in Laying Out Small Work

Removing Old Babbitt Metal from Bearing Boxes

Usually most of the babbitt metal can be removed from a bearing box with a cold chisel and hammer. If this procedure is not feasible, the box may be placed in a forge fire, and the babbitt melted out. The melting method is undesirable because of the probability of losing part of the metal. Where the bearing box is small the metal may sometimes be melted by the use of a blowtorch, and permitted to drop from the box into a suitable tray arranged underneath.—L. S. Sherman, Chicago, Ill.

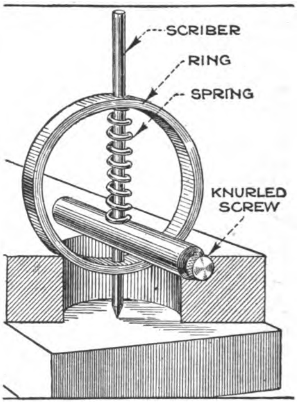
Drilling Hardened Steel

I have found the following method for drilling hardened steel very satisfactory. The usual pointed end of the drill is ground to a half-round shape, then made as hard as possible. The surface to be drilled is etched with dilute muriatic acid. Instead of oil, turpentine or kerosene in which a little gum camphor has been dissolved is used as a lubricant. Should the bottom of the hole become polished, so that the drill rides over it, remove the drill, etch the bottom of the hole with the acid, to roughen it, and proceed as before. —Wm. J. Edmonds, Rutland, Vt.

Transferring Hole Centers

The usual practice, when transferring the centers of large holes, is to scribe around the diameter and afterwards mark off the center of the scribed circle. The work is simplified considerably with the use of the tool shown in the drawing, which is made especially for this kind of work. A piece of good, straight tubing is drilled through for a scriber or pointer, and a short piece of round bar is also drilled the same size. This part is also drilled and tapped at one end, to take a knurled tightening screw, which extends up to the hole drilled through it.

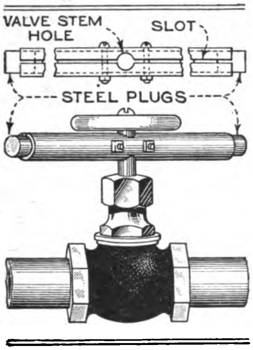
When finished, the parts are assembled as shown, with a light coil spring over the scriber. To transfer the center of a hole already drilled to another piece to be drilled the same size, the body of the tool is placed on top of the hole, and the scriber pushed down to touch the face of the second piece. Then with the knurled screw tightened, the tube is pressed down snugly and rocked back



and forth once or twice, the same procedure being carried out after the tool has been turned to a position at about right angles to the first. The result is a cross marked in the exact center of the hole. No accuracy is required when setting the scriber to depth; it must, of course, touch the face of the second piece, but if set a little heavy it will lift on the high spot as the tool is rocked.

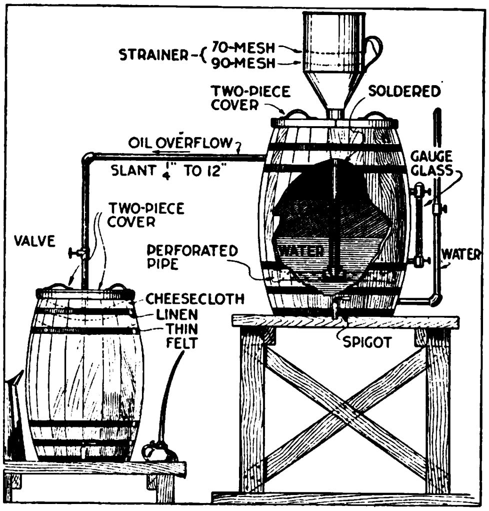
Quick-Acting Test Valve

The drawing shows how an ordinary valve, used to control the water pressure on a testing bench, was made quick acting. The testing operations made it necessary to open and close the valve every few minutes, and this consumed considerable time; whereas the device shown in the illustration enabled the operator to spin the valve wheel, opening and closing the valve in a fraction of the time otherwise consumed. The device consists of a short length of tube, two round steel plugs, and a couple of nuts and screws. The tube is drilled in the center to fit the valve stem and at right angles to this on each side to take the screws, and afterward slotted along its length as shown. The end plugs are a snug fit in the tube, and before the final tightening of the tube on the stem, the weights are moved in or out to attain correct balance. When correctly set, a slight spin of the wheel opens or closes the valve.



An Oil Filter and Tank for the Shop

An oil filter which may be constructed from two old casks in any small machine shop or garage will save many times its original cost in the reduction of oil bills. A 25-gal. cask and one of 15-gal. capacity are placed, as indicated, and connected by a pipe having a valve near the lower barrel. A ¾-in. water-supply pipe is led in near the bottom of the larger barrel, and a glass gauge is installed to determine the water level. A 2-in. vertical pipe, connected with a horizontal pipe at the bottom, is put through the head of the large barrel. The horizontal pipe is capped at both ends and has two rows of ⅛-in. holes drilled in it. A large funnel—an oilcan, as shown, may be used—is soldered to the vertical pipe and properly braced to the head of the cask. Two screens, one 70-mesh and the other 90-mesh, are soldered inside the body of the funnel, as shown in the illustration.



This Simple Filter Permits Old Oil to Be Used Many Times

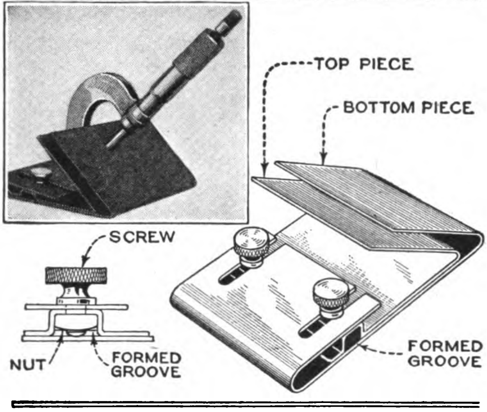
Water is let into the large cask to a depth of 18 in. and the perforated horizontal pipe is secured within 5 in. of the bottom. Used oil is poured into the funnel and is washed by rising through the water as it emerges from the perforations in the horizontal pipe. Sediment is deposited at the bottom, while the clean oil floats on top of the water until its level gets above that of the overflow pipe. When the valve in the overflow pipe is opened the washed oil runs into the clean-oil reservoir through a filtering layer of cheesecloth, and three layers of felt. This disposes of any foreign matter that may not have been removed in the washing. The filtering material should be removed and washed in kerosene whenever sediment is apparent.—John E. Cahill, Jr.

Auxiliary Grip for Valve Handle

It is sometimes extremely difficult to open a small-wheel valve, especially when the handle is oily or greasy. An aid in getting a good grip is to thread a piece of covered copper wire through the spokes and around the rim of the wheel. This enables one to grasp the wheel firmly regardless of grease on wheel or hands.

Micrometer Holder Keeps Oil from Spindle

When a micrometer is required for measuring work produced on a machine where cutting oil is used, it is a good plan to have some special device for holding it so that the oil will drain away from the spindle. As everything, including the operator's hands, is covered with oil, it is nearly impossible to keep the tool clean, but with a holder of the kind shown in the photo, the tool can be held in such a position that the oil will drain away from the thread, which would otherwise soon become inaccurate, due to the impurities that the oil contains.

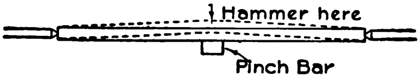


Simple Holder for Micrometer Used to Gauge Oily Work

The holder is made of two pieces of sheet metal, bent to the shape shown and held together with two thumbscrews, turning in nuts placed in a groove formed in the top piece. The bottom piece is slotted to make the holder adjustable, which is necessary to make the holder suitable for different settings of the micrometer on various jobs.

To Straighten or Bend a Shaft

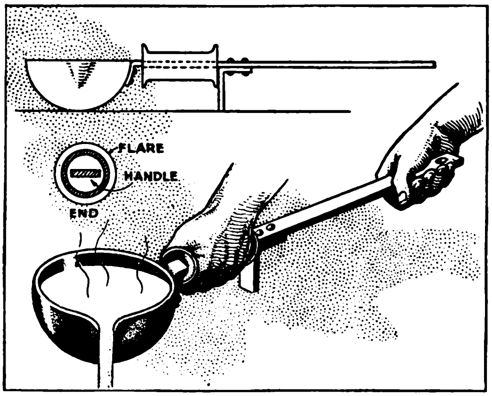
The principle of the method of bending a shaft here described applies to the straightening as well as the bending of bars, shafts or castings. In the sketch is shown a shaft which it is desired to bend in the direction of the dotted line. It is held in the center of a lathe, a pinch bar is pressed against the under side, and while thus sprung, the upper side is given repeated blows with a hammer, the heft of the blows depending upon the size of the shaft. In this way it is easy to give a permanent "set" to a piece. The piece may be held or clamped in any position or manner that suggests itself or is most convenient, the point of the trick being to hammer on the high side while in the sprung position. Heavy bars are easily set.—D. A. Hampson, Middletown, N. Y.



Bending a Shaft

Improving an Old Ladle

Small ladles for pouring babbitt or lead can often be improved as shown in the sketch. A piece of tubing, about 5 in. long and flared out at both ends, is slipped over the handle. A piece of steel, bent to a right angle, is then riveted onto the handle, back of the tube, serving the double purpose of holding the tube on and of forming a leg so that the ladle can be set down, if required, without tipping over. In order to serve its purpose well as a leg, this piece of steel should be at least 1 or 2 in. wide. By gripping the tube handle with the left hand and tilting the ladle by gripping the end of the long handle, with the right hand, the metal can be poured quite readily. Hold a piece of folded cloth, or soft asbestos, under the left hand around the grip, so as to protect the hand from the hot metal surface.



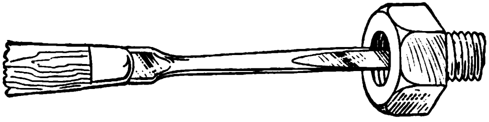
A Steel Leg, and a Grip of Metal Tubing over the Handle, Make the Old Ladle More Convenient in Use

Drawers under Bench Vise to Catch Filings

When working on costly metals a convenient method of preserving the filings is to have a tier of shallow drawers directly beneath the vise in which the work is being done. If it is lead upon which one is working, the top drawer is pulled out. The other drawers are used for copper, brass, aluminum, or bronze, as the case may be. Each drawer should be labeled and used exclusively for one kind of metal. It is then easy to collect and redeem the filings when a drawer becomes filled.

Removing Hot Nuts

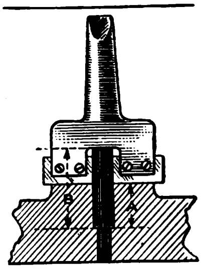
In removing nuts from hot engines, hot boxes or other hot parts, the method shown in the illustration is the one I use to hold the nut and keep it from falling into moving machinery. The nut is turned until it is almost off, then a screwdriver, scratch awl or a short piece of rod is placed against the head of the bolt and the nut is then turned off and on to the holding tool.—Herbert H. Van Kerner, Baldwin, Kans.



Taking Nut on Screwdriver

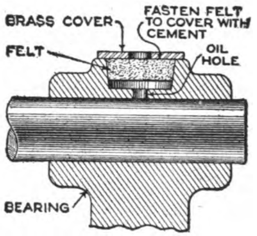
Facing Bosses to Gauge

In machining a large number of castings, the bosses of which had to be faced to an accurate dimension A, a simple gauge was made that greatly facilitated the operation, and prevented spoiled work. The facing tool used was of special form, as shown in the illustration, and a hardened-steel pin was used with it to serve as a gauge. The pin was of such a length that, with the tool seated on its top, the cutters had faced the boss to the correct height. Knowing that he could not spoil any work as long as the pin was in place, the operator made much better time than was possible by any other method.—J. H. Moore, Toronto, Can.



❡Steam jets are being advocated as the best means of cleaning dirt and grease from machinery, shaftings, journal boxes, pulleys, and the like, in shops.

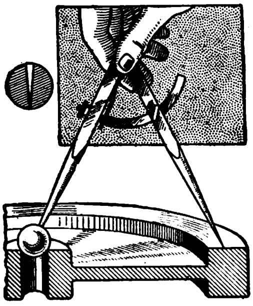
Cover for Oil Holes in Dirty Places



When oil holes on small shaft bearings are located in places where grit or dirt prevails, some sort of an oiling device should be used which will prevent the dirt from entering the bearing and scoring the shaft. Oil caps may be applied in some cases, but they are expensive and troublesome. In such instances an oiling arrangement similar to that here shown may be used. It consists merely of a cover of sheet metal for the oil hole, to which is attached a pad of felt. The felt can be cemented to the metal disk, which constitutes the cover, with thick white shellac. If the shellac is too thin, it can be readily thickened by igniting a small portion of it with a lighted match, and thereby burning out some of the alcohol. A cement thus prepared is impervious to oil and ordinary alkalies. The oiler is filled by running oil from the can into the hole in the cover disk, without removing the cover. The oil seeps down through the felt and lubricates the bearing, but dust and grit are excluded. The bearings of a polishing lathe, on which an abrasive dust was used, were equipped as above described, and their operation has been altogether satisfactory.—O. C. Richards.

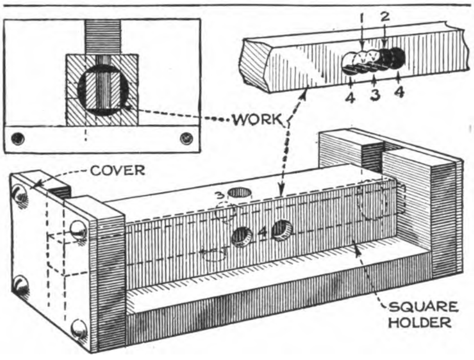
Sphere Attachment for Dividers When Measuring from Holes

It is sometimes necessary to mark castings a given distance from drilled holes. For such work a sphere attachment for the dividers, as illustrated, is useful. A smooth cast-iron or steel sphere having a tapered hole to take the divider point is secured, and is used as shown in the sketch. This attachment permits much greater accuracy than is obtainable by the use of a center-marked rivet or bolt.—W. H. Thomas, Davenport, Iowa.



Quick-Action Slot-Drilling Jig

The slot-drilling jig shown in the drawing is somewhat different in design, and much quicker in action than the usual type. Eccentric bushings, sliding pieces, and other similar methods for drilling holes close together, or to break into each other to form slots, are generally slow in action; but as many different holes as are necessary to form a slot of any length can be drilled by using this jig, and only one movement is required between holes. The job for which it was used was the cutting of a slot in the middle of a square shaft.



Quick-Action Slot-Drilling Jig for Cutting Slots in Square Shafts

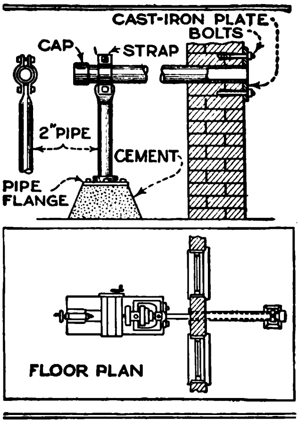
The main part consists of a base with two endpieces screwed to it; these are slotted in the center to the size of the shaft, and afterward thin metal covers are screwed to the outside faces. Next a square holder is cut to fit nicely between the endpieces and drilled along its axis to suit the corner-to-corner dimensions of the shaft. The sides of the holder are then drilled and reamed as indicated to take the drill and counterbore necessary to make the slot. This is done in the following way: Hole 1 is drilled first; the holder is lifted enough to clear the bottom of the jig so that it can be turned over to bring the next side uppermost, when hole 2 is drilled. The holder is turned again and a counterbore used to drill hole 3 between the two holes just drilled. The half holes, 4, at each end are then cut with the counterbore.

To Prevent Oil Sticking to Lubricator Glasses

To keep the inside of a lubricator glass free from oil, dissolve a very small piece of soap in the water. This will make the glass slippery and prevent the oil from adhering to the glass. A piece of soap put in the glass about once a week, will be sufficient to keep the glass always clean.—Harry Piel, North Bergen, N. J.

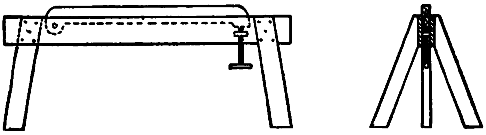
Setting Machines to Conserve Space

In order to conserve space without setting a number of bar-stock machines obliquely as is common practice, one concern has placed them at right angles to the wall and between the windows, the heads being next to the wall so that the operator gets the best possible light. This was accomplished by drilling the factory wall and supporting suitable lengths of pipe on standards on the outside; the pipes contained the bar stock, which was loaded through the headstocks from the inside. The pipes projected outside into space that would otherwise not be used. The same idea could be adapted to similar machines on an upper floor by supporting the pipes on the outside of the building by knee braces or suitable brackets. Aside from the economy of space effected, the shafts that drive the machines all run at right angles.



An Adjustable Balancing Trestle

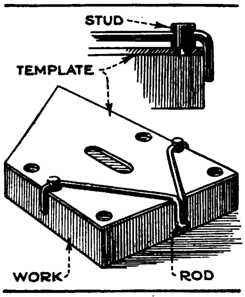
The trestle has three legs so that it can be set on any surface, no matter how uneven it may be. The top horizontal piece is provided with a metal bar, hinged at one end and having an adjusting screw at the other. A spirit level is attached to the bar. A pair of these trestles will enable one to do rapid work, as the leveling surfaces can be quickly set level.—John E. Elwing, McCleary, Wis.



The Horizontal Bar on the Trestle Crosspiece Can Be Easily and Quickly Set Level

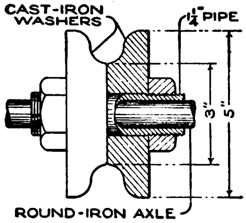
Attachment for Locating Template

Templates are usually the exact shape of the work they are used on and in many cases it is necessary to clamp them before marking off the job. If there are a number of pieces to be laid off, the locating and clamping of a template takes up considerable time. However, with the use of the clamp shown in the illustration the work can be greatly facilitated. Two studs, set on opposite sides, are riveted to the template as indicated and the heads are drilled to take a length of drill rod, which is doubled and bent to pass through the holes. In use, the template is placed on the work with the handle of the attachment in a vertical position. The end of the template where the handle fits over should be slightly out of line, that is, showing the work beneath, so that the ends of the handle locate the sides when the handle is pressed down and the double part, which is bent slightly outward, pulls the template along until it is flush with the end. Locating is thus effected very quickly and the attachment grips the work securely enough to prevent any movement while the marking off is being done.



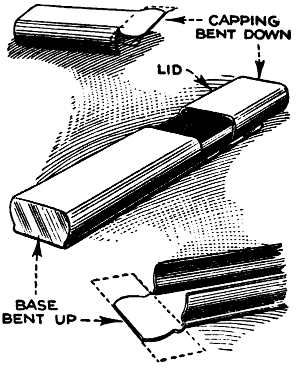
Sheave Made from Iron Washers in Emergency

To keep from shutting down on a job where 1-in. rope was to be run over sheaves, it was necessary to make a substitute for these fittings of the usual type, because they could not be obtained within reasonable time. Iron washers, 5 in. in diameter, were used for the purpose, and when fitted together on a bearing, as shown, did the work satisfactorily. The washers were set firmly between nuts on a short section of iron pipe. The bearing axle was fitted inside the pipe and suitably mounted. The sheave gave good service for a long time.—Herman F. Zimmermann, Los Angeles, Calif.



Cases for Small Tools

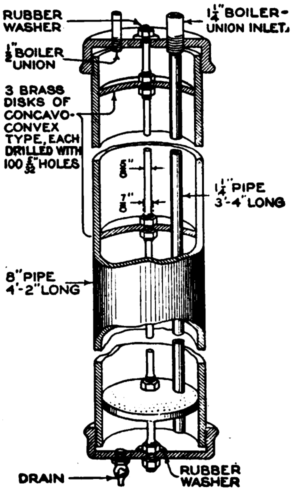
Handy cases for holding hacksaw blades, drills, files and other small tools that may be lost or damaged when lying around loose, can be made from metal molding, such as is used for interior wiring. This molding comes in two parts, the base and the capping that slips over the base. To make a tool case from this material, take a piece of the base of sufficient length and close one end as shown in the lower detail. The capping is cut in two pieces and the shorter one is closed at one end in the same manner as the base. The longer part of the capping is sweated to the base, while the other piece forms a sliding lid.—Thos. W. Benson, Philadelphia, Pa.



A Simple Compressed-Air Strainer

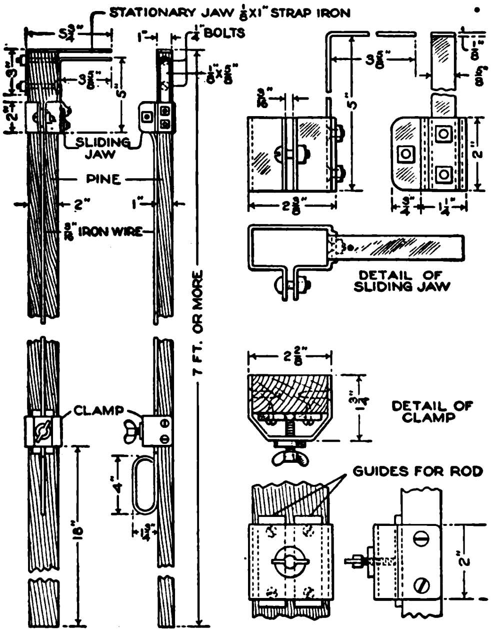
Among the various apparatus for extracting moisture from compressed air, the device shown in the drawing is one of the simplest and most efficient.

The strainer is made from a piece of 8-in. pipe, which forms the shell, two pipe caps and three perforated brass disks, which are held in place by an iron rod and nuts; these disks are dished, as shown, and perforated. From the drawing it will be seen that the moisture-laden air enters the strainer at the top and is carried to the bottom, whence it ascends through the disks to the outlet pipe at the top.



Calipers for Overhead Work Eliminate Use of Ladder

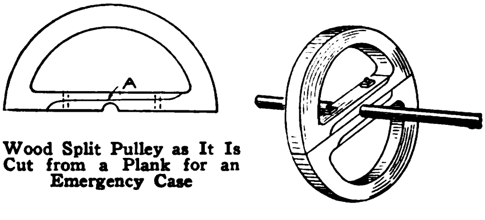
Ladders are usually treacherous, and this is especially true when they are used on the frequently greasy floor of machine shops or around machinery in operation. For calipering shafting, pipes, and other shop equipment that is out of reach from the floor, the stick illustrated is both a saver of time and a promoter of safety. The stick should be made from oak, or other clear hardwood. The metal fittings may be of any grade of steel that is soft enough to be readily worked. In use, the upper jaw is passed over the object to be measured. The lower jaw is moved until it is in firm contact with the lower surface, and is locked in that position by tightening the wingnut controlling the clamp mechanism on the handle. The size of the object calipered is then determined by measuring the distance between the caliper jaws with a ruler.



Construction Details of a Long-Handled Calipering Device, by the Aid of Which Shafting, Pipes, and Similar Overhead Mechanisms May Be Measured without the Use of a Ladder

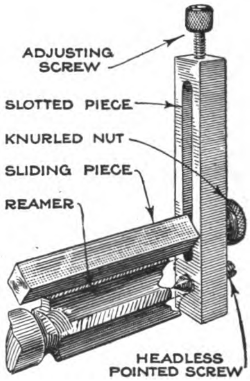
An Emergency Split Pulley

An emergency split pulley can be easily cut from a plank, and if great width is necessary, several planks can be placed side by side. A circle is drawn on the plank the size of the pulley. If the plank is not wide enough place two of them with their edges together. Draw another circle for the width of the rim and cut out the inside, leaving a crosspiece on one side of the diameter or center line. The saw is run into the part to be cut out on the line A. The shaft hole is cut out to fit snugly on the shaft and two holes bored through the spokes for bolts. A pulley can be quickly made in this manner, and it will answer the purpose as well as an expensive pulley.—E. Leslie McFarlane, Nashwaaksis, Can.



Wood Split Pulley as It Is Cut from a Plank for an Emergency Case

Measuring an Odd-Fluted Reamer

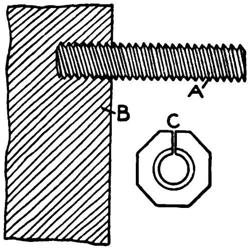


The large number of odd-fluted taps and reamers now on the market calls for some means of easy measurement as, obviously, these cannot be measured in the same way as the tools having an even number of flutes. The measurement of the odd-fluted tools is generally done by some more or less roundabout method, as by first reaming or tapping a hole and then measuring this to get the size. A useful tool can easily be made that will avoid uncertainty and delay, and, besides, will prove of great convenience in measuring the diameter of odd-toothed gears, although the latter require to be plugged for a center. The main part of the tool is made from 3/8 by 1/2-in. stock slotted and tapped for an adjusting screw at the top and for a headless pointed screw near the bottom. Next, a piece of 1/4-in. drill rod is turned down on one end to fit the slot, and threaded for a knurled nut. This sliding piece is then filed or machined to the diamond-shaped cross section shown and the turned portion that enters the slot should be large enough to allow it to be flattened on opposite sides so that the sliding piece will remain in the position shown. The headless screw is ground to a conical point and this completes the gauge.

When measuring a tap or reamer, adjust the headless screw until it fits the center snugly when the tool is flat against the end. Then by means of the upper adjusting screw bring down the sliding piece until it just touches the nearest tooth and then tighten the knurled nut. Now swing the whole tool around on the center until it is exactly opposite a tooth on the reamer and measure over the whole in the ordinary manner with a micrometer. Subtract the thickness of the sliding piece (.25 in.), which leaves the diameter of the tool.

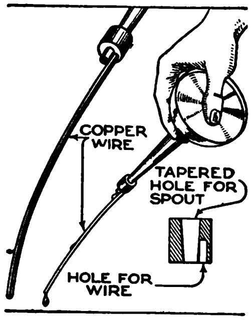
Removing a Threaded Stud

A threaded stud screwed solidly into metal is hard to remove without injuring the threads. Such a stud was in a flywheel of an automobile engine and I wanted to remove it without twisting the metal off or mashing the threads. The threaded stud A was very solid in the metal B. I used a split nut, C, clamped like the jaws of a vise over the threads, in turning the pin. The stud was thus easily removed and without injury to the threads. —Herbert A. Bartlett, Brockton, Mass.



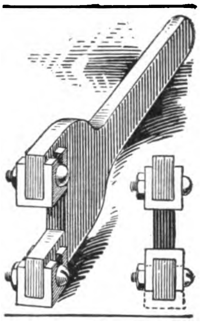
Increasing the Oilcan's Reach

By the simple expedient of making a small collar, having a tapered hole, to fit over the spout of an oilcan, and attaching a suitable length of stiff wire to the collar, the range of the oilcan may be considerably increased. The wire, preferably of copper, is soldered into a hole in the collar. In use, the collar with its attached wire, is slipped over the spout of the oilcan; the oil follows the wire and makes it possible to direct the lubricant into otherwise inaccessible places. The attachment can be put on or taken off the spout in a second.



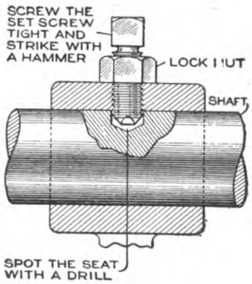
A Solid Adjustable Wrench

On production work it is highly desirable to use special wrenches with as little adjustment as possible, to suit the nature of the work for which they are used. A wrench of this kind, which was designed to fit three sizes of nuts, is shown in the drawing. The body of the wrench is made of flat stock and two small jaw pieces are bent and slotted as indicated to fit the jaws, and attached by means of small screws and nuts. When using the wrench on the largest size nuts, both jaw pieces are swung to the outside position as indicated by the dotted lines in the lower detail. When used for the next size, one jaw is swung to the inside, as at the left, and when used for the smallest size, both jaws are swung to the inside. This wrench was used on a milling fixture, where it was found much more convenient to have one wrench for this purpose than three separate wrenches.



Overcoming Setscrew Loosening

Cup-ended setscrews, which are used for holding collars, flywheels, gears, keys, etc., in place on shafting, frequently loosen and cause trouble, unless the setscrews are properly fitted. The best method of fitting such screws is to spot-drill the seat, and screw the setscrew in place firmly, then strike the head of the setscrew sharply several times. The final tightening gives the cup face a firm seating on the shaft, and it is not likely to loosen. A hexagonal nut will give additional security if placed in the setscrew and tightened after the setscrew has been upset with the hammer. This will lock the piece against loosening, even though there is excessive vibration.—Geo. A. Luers, Washington, D. C.

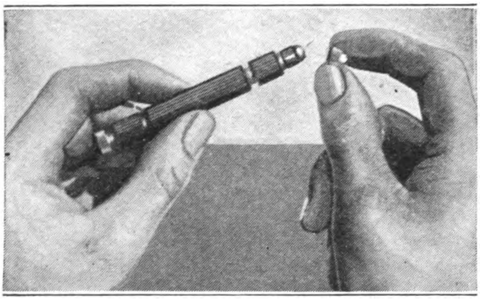

SCREW THE SET SCREW TIGHT AND STRIKE WITH A HAMMER
LOCK NUT
SHAFT
SPOT THE SEAT WITH A DRILL

¶White lead makes a good lubricant for heavy worm gears.

Steel Balls Compensate for Gauge Wear

Made in a large variety of sizes, 1 in. and over, a new gauge for internal diameters is particularly useful for rapid inspection.

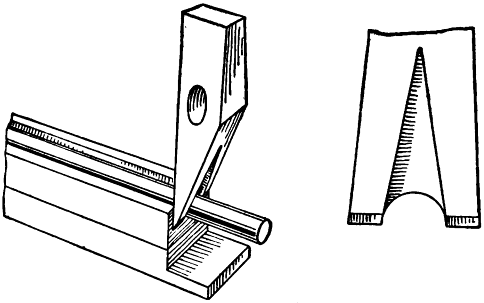
The stem of the gauge is cupped at both ends to hold a 5/16-in. steel ball, held in place by a threaded sleeve. The actual measuring contacts are thus furnished by the steel balls, and compensation for wear may be attained by loosening the sleeves and turning the balls slightly to expose unused portions of their surfaces In this way the accurate length of the tool may be retained for an indefinite period.



The Length of This Gauge Is Kept Accurate by Means of Steel Balls

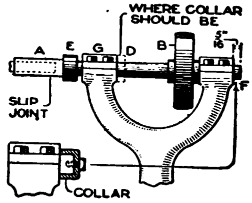
Cutting the Ends of Round Stock

The base of the cutting tool is forged the same as a swage and capped with steel. An offset is formed to provide a cutting edge and a soft base for the chisel edge to strike when it cuts through the metal. The semicircle in the chisel edge should have a long slope filed so that it will extend upward on the sloping side of the chisel. The steel cap is rounded out to fit the round stock. A tool of this kind can be made to cut any size round stock. The larger sizes should be cut hot. Both tools should be tempered, in the same manner as chisels.—D. O. Wilkins, Hempstead, Tex.



Cutter and Die

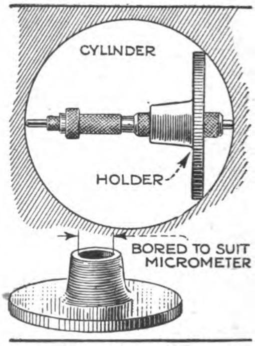
Collar for Flue-Cutter Slip-Joint Shaft



It was necessary to provide a collar on a flue-cutter shaft to prevent longitudinal movement of the shaft, because without the collar the shaft would work over so far that the belt slipped from the pulley B. The machine could not be taken apart to place a set collar at D where it should, under ordinary conditions, be located. A clamp collar might have been used, but this would involve the installation of a guard for it. When the shoulder E was close to the box G there was not enough shaft exposed at F to accommodate a set collar. The small detail at the left shows how the problem was solved. A cap of 2-in. outside diameter was made. It was counterbored 5/16 in. to fit over the shaft and was held in place by a screw turning into a tapped hole in the end of the shaft, as shown. This screw has a round head to prevent its catching on objects and is pinned to prevent it from turning out. Thus an effective "end collar" was provided.—A. G. Corssen, Centralia, Illinois.

Holder for Inside Micrometer

When using an inside micrometer, it must be moved vertically and horizontally, and considerable adjustment is necessary to obtain an accurate measurement. The work can be greatly facilitated by using the attachment shown in the illustration, which makes it possible to set the tool across the center of the bore at once. The attachment is a circular disk of brass, or steel, with a boss which is drilled to a good sliding fit on the thimble of the micrometer, so that it can be slipped on and off easily. The diameter of the disk is about 2½ in. when used for bores having a diameter of 5 in. or more. For smaller bores, the diameter should be about 2½ inches.



Improved Caliper Gauge

Every machinist and toolmaker has undoubtedly experienced some trouble in gauging parallel surfaces with a caliper gauge, especially at the moment when the work is about to enter the jaws of the gauge. If the gauge is held so that the jaws are slightly inclined to the surfaces to be gauged, the piece will not enter the gauge, even if it should be several thousandths of an inch under size. This condition is indicated in Fig. 1.

In Fig. 2 is shown a caliper gauge which eliminates this difficulty, and allows the gauging to be done quickly and accurately. When this gauge is used, the long jaw A is held against one of the sides of the piece to be gauged and moved along it until the piece enters completely between the jaws, provided it is of the correct size or under size. If the piece is above the correct size, it will be brought to a stop against the gauge as soon as the short jaw B is reached.

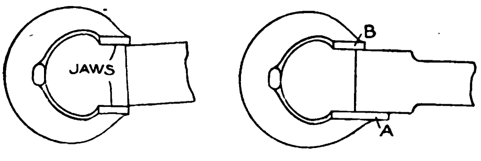
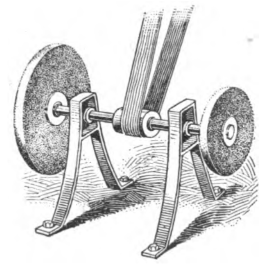


Fig 1 Fig 2

Gauge for Calipers

Shafting Hangers Converted into Neat Bench Buffer

Many shops where the position of overhead shafting has been changed, can find use for a pair of shaft hangers, which may have been left over, to fit up a bench buffer. A short piece of shafting is mounted, as illustrated, with collars and setscrews to keep it in place lengthwise, and buffing or polishing wheels are mounted on the two ends. It is not desirable to run a heavy emery wheel at high speed on ordinary shaft hangers, as they are not built for such service, but for buffing and polishing of various kinds the arrangement does very well. The cost of construction is practically nothing, as no material need be purchased. — Ernest Schwartz, Brooklyn, N. Y.



Belt Punch Used for a Brush Handle

Many times a workman in a machine shop wishes to use a small brush and does not have one at hand. Belt punches are more numerous than brushes in such a shop and one of these can be used as a handle. The bristles or a substitute can be drawn into the hole with a string to make the brush part. In Fig. 1 is shown the method of drawing the bristles in place and in Fig. 2 the completed brush.—Geo. Schneider, Cincinnati, Ohio.

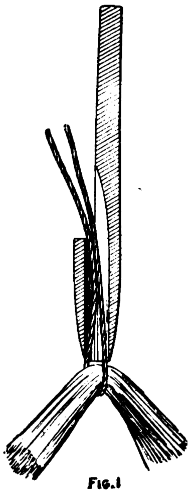


Fig.1

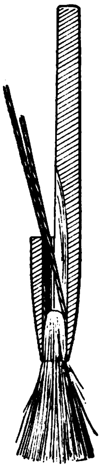
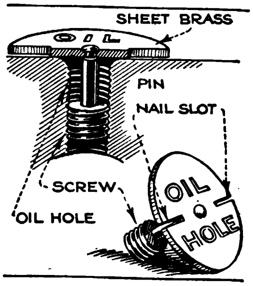


Fig.2

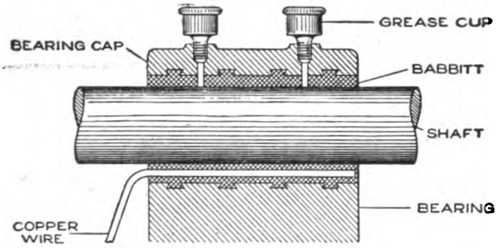
Oil-Hole Covers

Insufficient lubrication is the root of many machine troubles and a frequent cause of this is the general custom of furnishing machines with oil holes that are simply plugged with short headless screws, which often become entirely covered with dirt and grease so that they cannot be easily located. In order to make oil holes easily recognized, a pattern shop uses the covers shown in the illustration. Each consists of a circular piece of sheet brass with two short slots cut in it as shown, and a pin driven tightly in the center, the other end of the pin carrying a short screw which also fits tightly. Space is left between the cover and screw to allow it to be easily screwed down in the oil hole, which is tapped for this purpose. To place or remove the cover over the oil hole the finger nails are inserted in the slots. When stamped with plain letters, this cover is easily noticeable, even in out-of-the-way places, and, being very thin, it does not foul working parts.

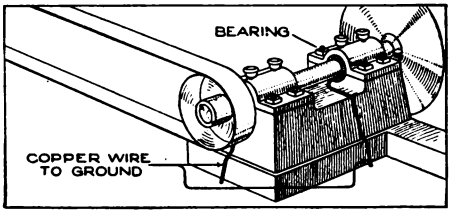


Cooling Large Bearings with Grounded Copper Wires

Large bronze, or babbitt, bearings are effectively reduced in temperature, and static electricity is abolished, by connecting a large copper wire from the bearing to the ground. The heat is radiated over the wire and much of it is lost in the air. That which reaches the ground is absorbed. If the ground wire is placed in moist earth, cooling is all the more effective. The larger the diameter of the ground wire used, the faster will be the radiation of heat.



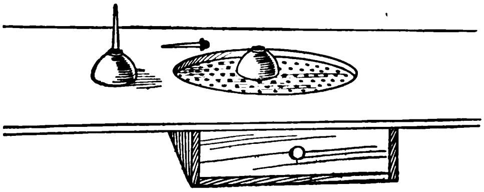
SECTION VIEW OF BEARING



Heat Created by Friction and Static Electricity Is Radiated from the Bearing by a Large Copper Wire

Preventing Waste in Filling Oilcans

In stock rooms, or places where oil is supplied to men through a window, a considerable amount is usually spilled or dripped from the cans being filled. In wiping this up a dangerous accumulation of oily rags, or waste, results. This can easily be avoided and an appreciable oil saving effected by the means illustrated. A portion of the window sill is cut out, and covered with a perforated plate or wire screen. Under this is placed an oil-tight drawer, or receptacle, for catching the oil as it drips from the cans, which may be removed as desired or necessary.—George Jaques, Chicago, Ill.

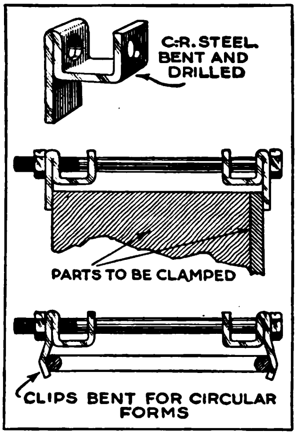


An Oil-Tight Drawer Catches All the Drip from Cans Being Filled at the Window

Simple and Inexpensive Clamps

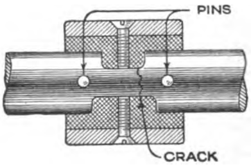
When a clamp is required in a hurry, and the available ones are too short, or too bulky for the space in which they must be applied, the form of clamp illustrated may be used to advantage.

Two pieces of flat cold-rolled steel are bent to the shape shown, and drilled to accommodate a bolt or threaded rod. If the piece to be clamped is of circular section, the clips may be bent as indicated in the lower drawing.



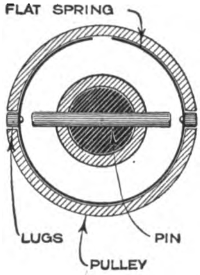
A Temporary Shaft Repair

Shafts will break down at inopportune times when the possibility of a permanent repair is out of the question, and at one such occurrence, the difficulty was overcome in this manner: The shaft gave way at the point indicated. The first thing done was to cut two flats on opposite sides of the shaft. A piece of cast-iron pipe was placed over the shaft, holes were drilled through both pipe and shaft, and pins inserted to hold the ends of the latter together. Afterward two other holes were drilled and tapped and provided with set-screws, and the space between the pipe and shaft was filled with melted babbitt, making an excellent temporary repair.



¶Rusted or tight screws holding metal parts together can be loosened by holding a red-hot iron of the proper size on the head of the screw. After cooling, the screws can be turned out easily.

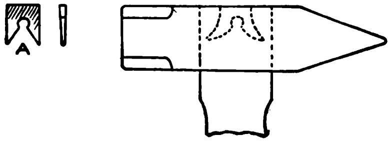
Lock for Pulley Pin



When a pulley of the type shown is provided with a pin for keying it to the shaft, and holes through the rim for driving out the pin are necessary, it is possible, by the method illustrated, to provide against danger of the pin working out. A long pin is used, and a piece of clock spring is formed to fit inside the rim. Two small lugs are soldered to the clock spring, so as to fit into the holes in the rim. The pin cannot then work out, no matter how loose it is, until the spring is removed.

Wedge for a Hammer Handle

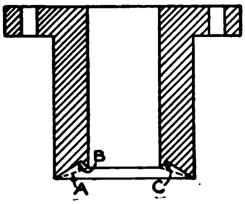
A common wedge in a hammer handle usually comes loose in time and causes considerable trouble to keep the hammer tightly on the handle. If the wedge can be kept in place, the hammer will not loosen on its handle. A simple wedge that will not come out is shown at A in the sketch. It is made of soft steel. When driven into the hammer handle, the wood spreads the two prongs so that it is impossible to pull the wedge out



Shape of the Wedge

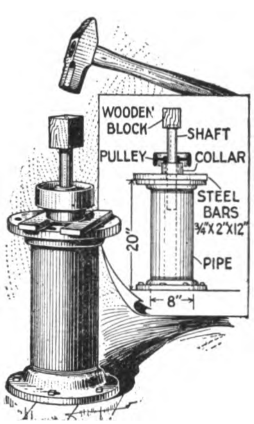
Shaping a Stuffing-Box Gland

The straight taper on a stuffing-box gland should be turned to a double taper as shown in the sketch to hold the packing on a worn piston rod. The straight taper A squeezes the packing against the rod, and if the rod or hole is worn, the packing will blow out. But if the taper is cut as shown at B, the packing will be squeezed also against the small taper C, which keeps it from blowing out through the worn hole.—Joe V. Romig, Allentown, Pa.



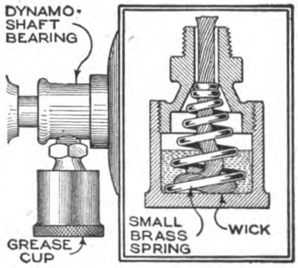
Block for Driving Mandrels and Similar Machine Parts

Many shops are unprovided with a block for driving mandrels, or other machine parts requiring a driven fit, and in consequence workmen are embarrassed, and much valuable time is lost on the occasional jobs of this sort that arise. By fitting machined collars on the ends of a piece of heavy iron pipe and bolting its lower end to the floor, a driving block, as illustrated, may be quickly contrived in any shop. Two steel bars, 12 in. long, 2 in. wide, and ¾ in. thick, should be provided for use as rests under small work. A soft hammer, or a block of hard wood, should be used on jobs where there would be danger of swelling the end of the shaft. The diameter of the opening in the end of the driving block should be large enough to insert the hand if parts are dropped inside.



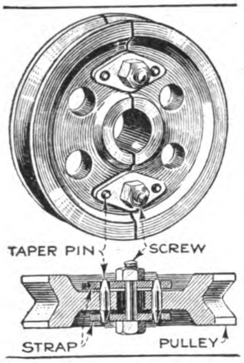
Wick-Feed Oiler Made from Grease Cup

A satisfactory homemade wick-feed oiler can be applied to the bearings of a dynamo or similar mechanism, so that the necessity of constant hand oiling, with the attendant possibility of flooding, are eliminated. A large grease cup is screwed to the underside of the bearing, with a piece of wicking extending through it and touching the revolving shaft. The cap of the grease cup serves as a reservoir for a liberal supply of oil. This is a simple method, for use where small quantities of oil are required, and where excess oiling is to be avoided.



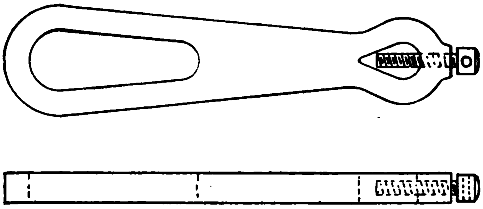
¶When a split bearing will serve the same purpose as well, do not use solid bearings in machines.

Clamping a Grooved Pulley



The novel pulley clamps shown in the illustration were successfully adopted when it became necessary to place a grooved pulley on a shaft already in place. To enable the pulley to be placed without disturbing the shaft the following work was done: First, four small holes were drilled as shown and pins slightly tapered at both ends were driven in place; two holes for bolts were then drilled, and four clamping pieces drilled in the center to clear the bolts used for tightening, and at either side to suit the pins, the distance between the holes being a little less than the center-to-center distance of the pins. The pulley was then sawed in two, on the line of the bolt holes. When assembled on the shaft the bolts were tightened, which drew the clamps together; the center distance of the holes being less than that of the pins, both sides of the pulley were drawn together, binding it securely on the shaft.

A Hand Dog



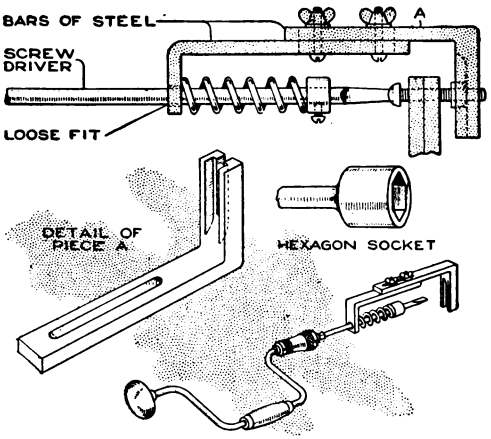
Hand Dog for Holding Small Drills When Drilling in a Small Bench Lathe

Frequently a very useful tool is also a very simple one. The little hand dog shown in the illustration is an example. The uses of this tool are numerous. It may be used for holding a large variety of drills when drilling in a bench or small engine lathe. It is also very handy for holding small round stock while centering. In short, it does most of the work of a common lathe dog.

The body and screw should be hardened. An attractive appearance may be given it if, in hardening, a mottled effect is added, provided it is machine steel. The handle may be made solid or skeleton, and the screw, either as shown or in the form of a thumbscrew.

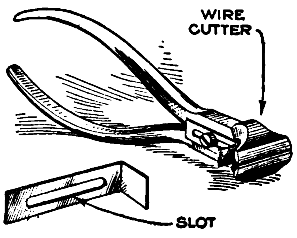
Device for Tightening Bolts Quickly with Brace

In assembling stoves and many other varieties of work where large numbers of small bolts are used a brace-attachment tool as indicated in the sketch is a great saver of time and labor. It is only necessary to start the bolts with the fingers, after which they are held and tightened practically by a single operation of the tool. A hexagon socket to be inserted in the brace permits the same application with headcap screws.



The End of the Tool Holds the Nut While the Bolt Is Sent Home with a Few Turns of the Brace

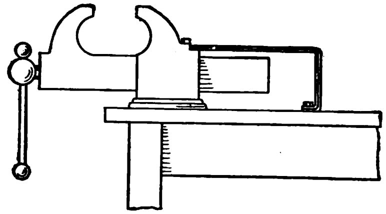
Gauge for End-Cutting Pliers



When cutting off rivets or wire pins with pliers, particularly with the end-cutting type, the pieces will not be uniform in length unless a gauge is provided. The gauge also prevents the cut-off pieces from flying and causes them to fall straight down. The gauge is simply made, and consists of nothing more than a strip of stiff sheet metal, bent at right angles and provided with a slot, so that it can be attached to the pliers with a screw, in the manner indicated.

Guard for the Sliding Jaw of a Vise

There is no member of the bench vise more abused by the careless workman than the screw of the sliding-jaw part. It affords a ready but costly means of cutting wire and other small stuff with a hammer, to the destruction of this part of the vise and its roughing so that it will not pass freely through the slot in the guide-jaw head.

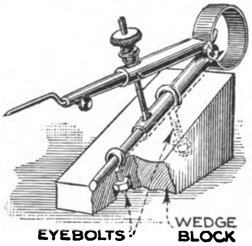


A Guard to Protect the Sliding-Jaw Part of a Bench Vise

The sketch shows a guard strip securely bolted to the bench over this portion of the vise, to afford a permanent and lasting protection for it. In a large shop, where laborers of all kinds are allowed access to vises, this safety device would reduce repair expenses to a great extent.—F. W. Bently, Jr., Milwaukee, Wis.

A Homemade Surface Gauge

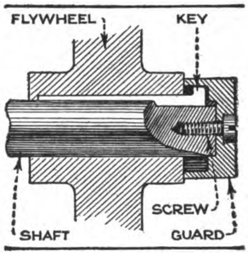
An apprentice in a machine shop did not like the idea of buying a surface gauge, which he needed, but decided to make one himself. He obtained an old pair of spring calipers with one leg broken off and the other leg worn down. After grinding both legs down to the same length he made a wedge-shaped block with a groove in the top to fit one leg, and drilled and counterbored two small holes through the block for eyebolts, which were used to hold the leg on the block securely, as shown. He also drilled and tapped a small hole through the other leg for a thumbscrew, which was used to hold a scratch pin slipped in a slot cut lengthwise in the end. The resulting gauge gave just as good service as a regular one would have done.—Frank N. Coakley, Buffalo, New York.



¶Rough castings should never be slid on machine beds.

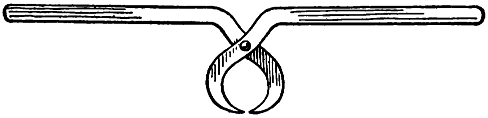
Gib-Head Key Guard

An effective guard for gib-head keys of the kind shown in the illustration not only prevents a loose key from coming out, but it also eliminates the danger of having the projecting head of a revolving key catch the workman's clothes, consequently causing injury. The guard consists of a cast-iron cap fastened on the end of the shaft so that it covers the head of the key. The cap is attached by means of a machine screw driven into a hole drilled and tapped in the end of the shaft. The hole in the cap is counterbored to take the screw head.



Tongs for Carrying Large Shafting

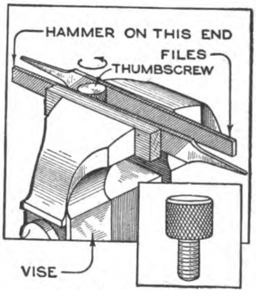
It is unsatisfactory to carry large shafting by hand as it cannot be laid down without the risk of injuring a finger. Tongs made as shown in the sketch are very convenient, as four men can carry large shafting, easily picking it up or laying it down.



Shafting Tongs

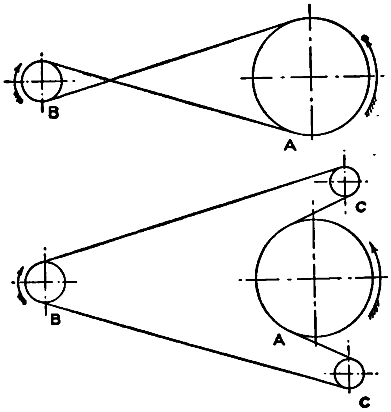
Knurling in the Vise

Handles, thumbscrews, and other parts that must be knurled, or would look better if so treated, can be easily knurled without a lathe and the usual tools. All the apparatus required consists of two files and a vise. As shown in the drawing, the work is clamped in the vise between two files, the knurl being obtained by hammering on the end of one of the files, as indicated. Finer or coarser knurls are obtained by using files of different cuts.



Belting a High-Speed Fan

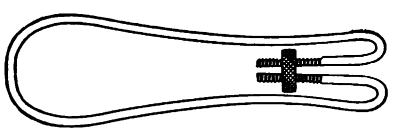
A fan requiring a high speed and running in the opposite direction of the line shaft caused considerable trouble in wearing and burning out the cross belt that drove it. The usual manner of belting the fan is shown in the first sketch, in which A is the driving pulley and B the fan pulley. The belt expense was greatly reduced by changing the drive as shown in the second sketch. The two idler pulleys, CC, permitted the belt to run straight, yet the reverse direction of the fan pulley B was obtained.—Joseph Flood, Philadelphia, Pa.



Idler Pulleys Used to Make the Drive Belt Run Straight Instead of Crossed

An Adjustable File Handle

The handle is constructed of round machine steel, ¼ or ⅜ in. in diameter and about 15 in. long, which, when bent over in the shape shown, will leave the handle part about 5 in. long. Before making the bend the ends are threaded with a small die, having the same number of threads as those cut in a ¾-in. nut. The steel is then bent in the shape shown, and the inside portion of the threaded ends are filed flat to admit the shank of the tool. A ¾-in. nut is used on the threads.

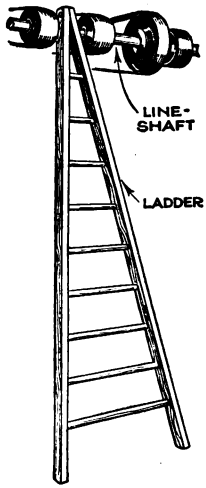


The Tapering Portions of the Threaded Ends Are Easily Clamped on the Tool Shank with the Nut

The tapering shank on most hand tools can be inserted between the two ends, and the sloping parts are easily clamped on it by turning the nut.—G. H. Holter, Jasper, Minnesota.

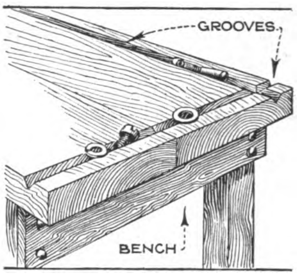
Ladder for Work on Shafting

An ordinary ladder is more or less unsuited for such work as oiling lineshaft hangers, repairing belts, and the like. The ladder shown in the drawing has many advantages for work of this kind, as it is not top-heavy, and can be rested against the shafting when the pulleys are but a few inches apart. The top of the ladder should be as narrow as possible, while the bottom should be at least 3 ft. wide, so that it can be rested on a minimum of space and yet not slip to one side when the workman leans to one side or tugs at a pulley or belt. A hook at the top to fit over the shaft and spikes at the bottom are suggested as measures for reducing the possibility of accident.



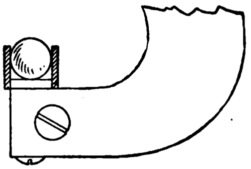
Groove in Bench Prevents Parts from Rolling Off

The usual method of preventing small parts from rolling off a workbench is to nail a strip of wood on the bench top, near the edges. However, it is not always desirable to have such a strip on the bench, as it often proves to be a hindrance in working, and therefore a V-shaped groove cut along the edges as shown in the illustration has been found much more satisfactory. The groove is about 1 in. wide and about 2 in. from the edge of the bench top. It takes only a few minutes to cut the groove by means of a carpenter's grooving plane.



¶All bearing surfaces on machinery should be as large as is practicable, insuring against undue wear. Compensation for wear should also be provided for.

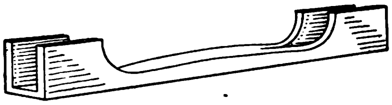
Measuring Tubing with an Ordinary Micrometer



A little inexpensive attachment for any ordinary micrometer can be made for accurately measuring the walls of tubing. The attachment is made as follows: A piece of 5/16-in. cold-rolled steel is drilled to make a push fit for a 1/4-in. hardened steel ball. The steel is fitted snugly on the anvil of the micrometer. The steel ball is adjusted in the bushing so that it will protrude 1/16 in. The bushing is then placed on the anvil of the micrometer so that the ball touches it. In measuring the wall of a tubing all that is necessary is to subtract 1/4 in., or .25 in., the exact size of the steel ball, from the amount designated on the scale.—Walter Butz, Pearl River, N. Y.

Combination Side and End Wrench

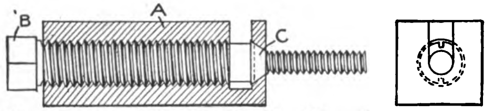
A very handy all-around wrench can be made by shaping the jaws from a piece of steel—a piece of buggy spring will do— as shown in the sketch. The size and thickness of the wrench will depend on its use. This makes a side and end wrench. —C. C. Hall, Eureka Springs, Ark.



The Construction of the Jaws Makes a Side and End Wrench of One Piece

Holding Countersunk Screws to Thread Up to the Head

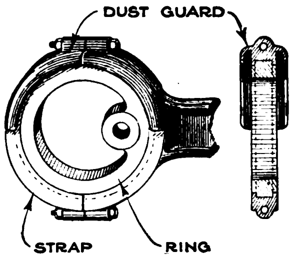
The device illustrated was made for holding countersunk screws so that they could be threaded up to the head. It consists of a body, A, drilled and tapped to receive the plug B, which is a trifle larger than the head of the screw to be threaded. The hole C is countersunk for the screw, and then slotted to permit the head of the screw to be slipped out by slightly loosening the plug.



The Screw Is Held Tightly in Place So That the Threads Can Be Cut Close to the Head

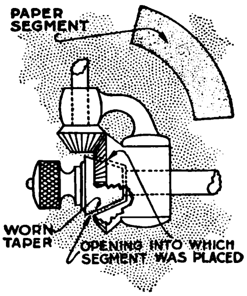
Dust Guards on Eccentric Straps

The sliding and revolving parts of machinery used for coal, ashes, and sand, are continually exposed to more or less gritty dust, which quickly destroys the reciprocating and revolving parts and their bearings. The drawing shows an eccentric for an automatic boiler stoker, which has been fitted with a dust guard to prevent coal dust from shortening the life of the eccentric straps. The dust guard, or cover, is cast on both sides of the upper strap, deflecting the dust that would otherwise fall directly onto the revolving sheave.



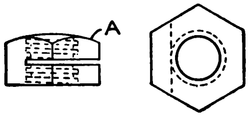
Paper Shim Makes Worn Taper Grip Tightly

When tapers in friction grips, and similar machinery, are so badly worn that they strike at the end instead of gripping, they may be used by inserting a paper shim. The paper may be cut from any at hand, and the general shape will be as illustrated. Cutting the shim to the exact shape is a not difficult geometrical problem, but takes more time than is necessary; the shape can be guessed at close enough after a few trials.



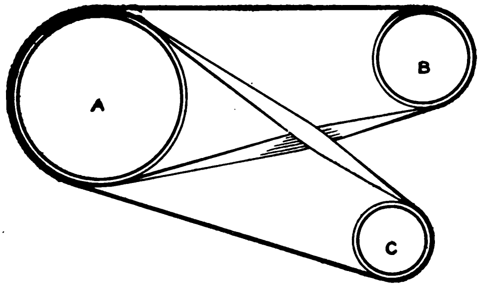
A Remedy for a Loose-Fitting Nut

A loose nut may be made to fit the threads of the bolt tightly by cutting a slot in the side, a trifle over half way through the nut, and striking it at A with a hammer to close the opening and shorten the pitch of the threads. The nut will turn on tightly, and where the threads fit very closely it takes the place of a locknut.



Two Pulleys Driven by One Belt without Idler

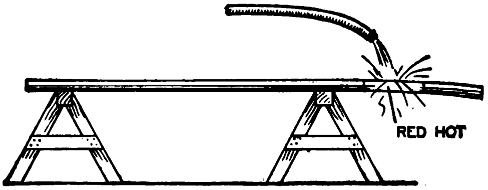
The illustration shows a way of driving two smaller pulleys from one wheel by means of one belt without an idler for the purpose of securing the required arc of contact on the small pulleys. The belt is placed on the driver A, then twisted as a crossed belt between the pulleys B and C, and passed over them in the manner shown. This will produce the effect of running two belts on A, one over the other.—James E. McCormack.



One Belt on One Driver Runs Two Small Pulleys without an Idler between Them

Straightening a Small Bend in a Large Shaft

Place the shaft upon the horses and set a forge under the bend and heat it to a bright red, then remove the forge or roll the shaft along the horses until it clears the forge and turn the shaft so that the bow will be up. Apply a small stream of water on the center of the bow. This will cause the top to cool and contract while the lower side remains hot, thus stretching the lower side and straightening the shaft. I have tried this on a large screw, 5 in. in diameter, and the results were satisfactory. If a lathe is not available to make a test for straightness, use a straightedge.—F. J. Schenck, Hugo, Oklahoma.

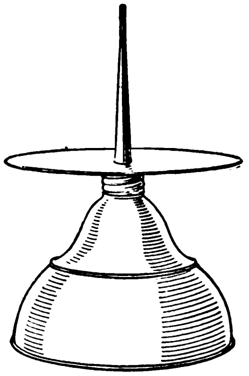


Straightening by Contraction

¶Oilcans should be marked to indicate the kind of oil in them.

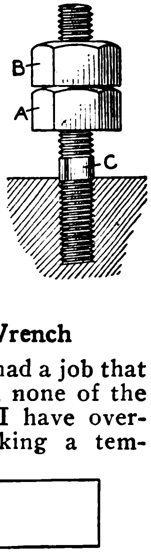
To Prevent Spilling Oil from Tipped-Over Can

Oilcans are easily turned over when working about machinery, and a considerable amount of oil is wasted before discovered. A very simple little device to overcome this trouble can be made by anyone in a few minutes. Solder a disk of sheet metal on the upper surface of the base on the spout. The disk should be a little larger in diameter than the bottom of the can. This will prevent the oil from running out of the can when upset.—Stanley Radcliffe, Laurel, Md.



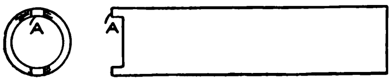
To Remove a Stud

A very effective way to remove a stud is shown in the accompanying sketch. Two nuts are turned onto the stud C; the wrench is placed on the nut A and turned to the left, the nut B locking A and keeping it from turning off. The stud may be turned in the opposite direction by applying the wrench on the nut B. This plan will be helpful on many occasions.—Chas. T. Richards, Philadelphia, Pa.



Substitute Spanner Wrench

Many times when we have had a job that called for a spanner wrench, none of the proper size was available. I have overcome this difficulty by making a temporary spanner of a short length of pipe having the proper diameter, and cutting the end with a hacksaw to make the projections. This will remove the nut without injuring it in any way.—Jas. S. Frear, Sidney, N. Y.



When Necessary a Spanner Wrench Can Be Cut on the End of a Piece of Pipe

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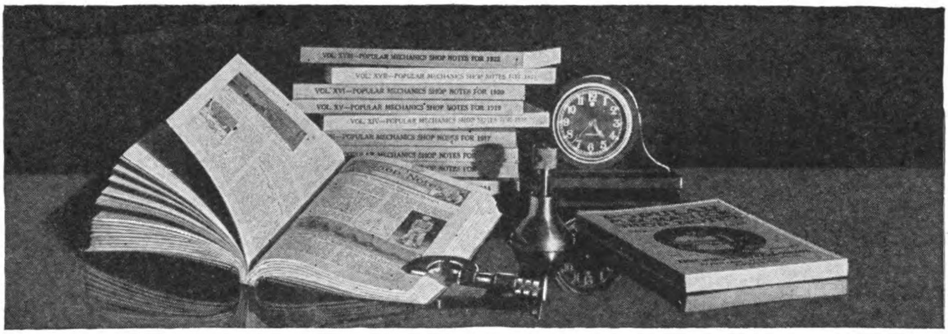

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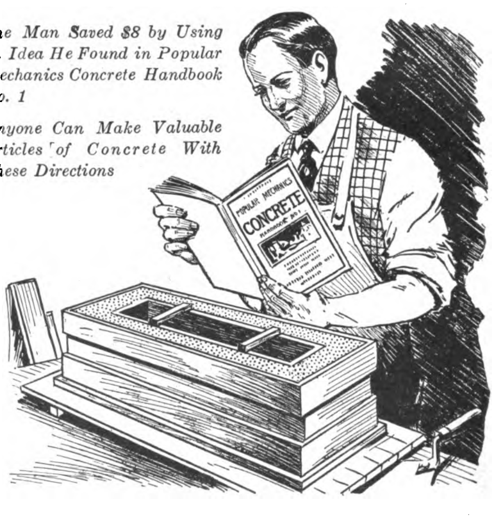

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